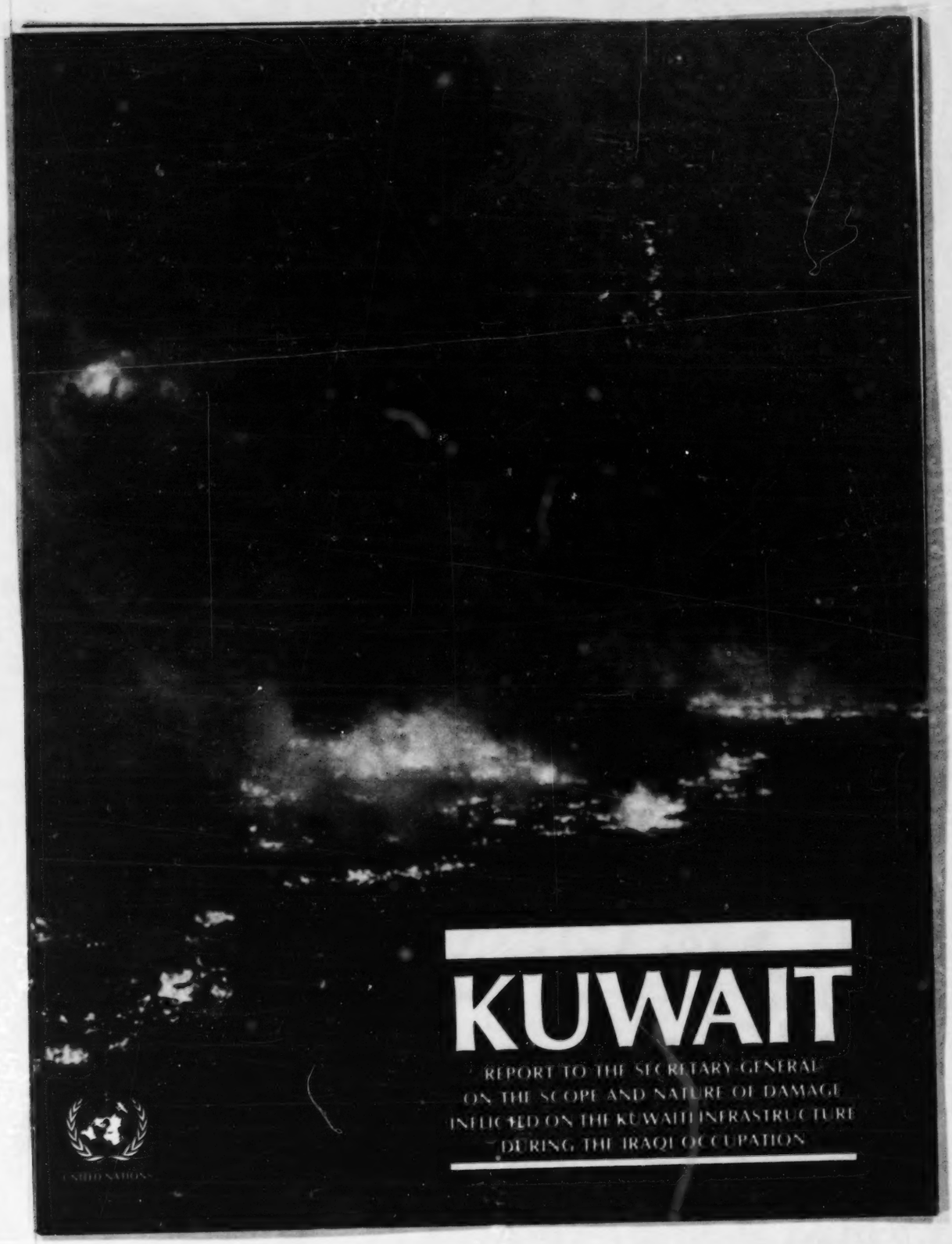

KUWAIT

REPORT TO THE SECRETARY-GENERAL
ON THE SCOPE AND NATURE OF DAMAGE
INFLICTED ON THE KUWAITI INFRASTRUCTURE
DURING THE IRAQI OCCUPATION

UNITED NATIONS

LETTER DATED 26 APRIL 1991 FROM THE SECRETARY-GENERAL ADDRESSED TO THE PRESIDENT OF THE SECURITY COUNCIL

In my letter of 1 March 1991 to the President of the Security Council (S/22333), I brought to his attention a letter I had received from the Permanent Representative of Kuwait requesting that a mission be dispatched immediately to that country to assess the losses of life incurred during the Iraqi occupation of Kuwait and to examine the practices by the Iraqi occupation forces against the civilian population in Kuwait. He had also requested that the team assess the damage inflicted on the general infrastructure in Kuwait.

In his letter of 6 March 1991 (S/22334), the President of the Security Council informed me that members of the Council would welcome my responding positively to that request, recognizing the importance of taking all actions possible to facilitate Kuwait's reconstruction and reintegration into the international economic system.

Accordingly, I requested Mr. Abdulrahim A. Farah, former Under-Secretary-General, to lead a high-level United Nations mission to Kuwait. The mission visited that country from 16 March to 4 April 1991. The report of the mission on the damage sustained by the infrastructure and economy of Kuwait during the Iraqi occupation is submitted herewith for the attention of members of the Security Council.

UNITED NATIONS

Javier Pérez de Cuéllar

Issued as Security Council document S/22535

ANNEX

REPORT TO THE SECRETARY-GENERAL

BY A UNITED NATIONS MISSION, LED BY MR. ABDULRAHIM A. FARAH, FORMER UNDER-SECRETARY-GENERAL, ASSESSING THE SCOPE AND NATURE OF DAMAGE INFLICTED ON KUWAIT'S INFRASTRUCTURE DURING THE IRAQI OCCUPATION OF THE COUNTRY FROM 2 AUGUST 1990 TO 27 FEBRUARY 1991

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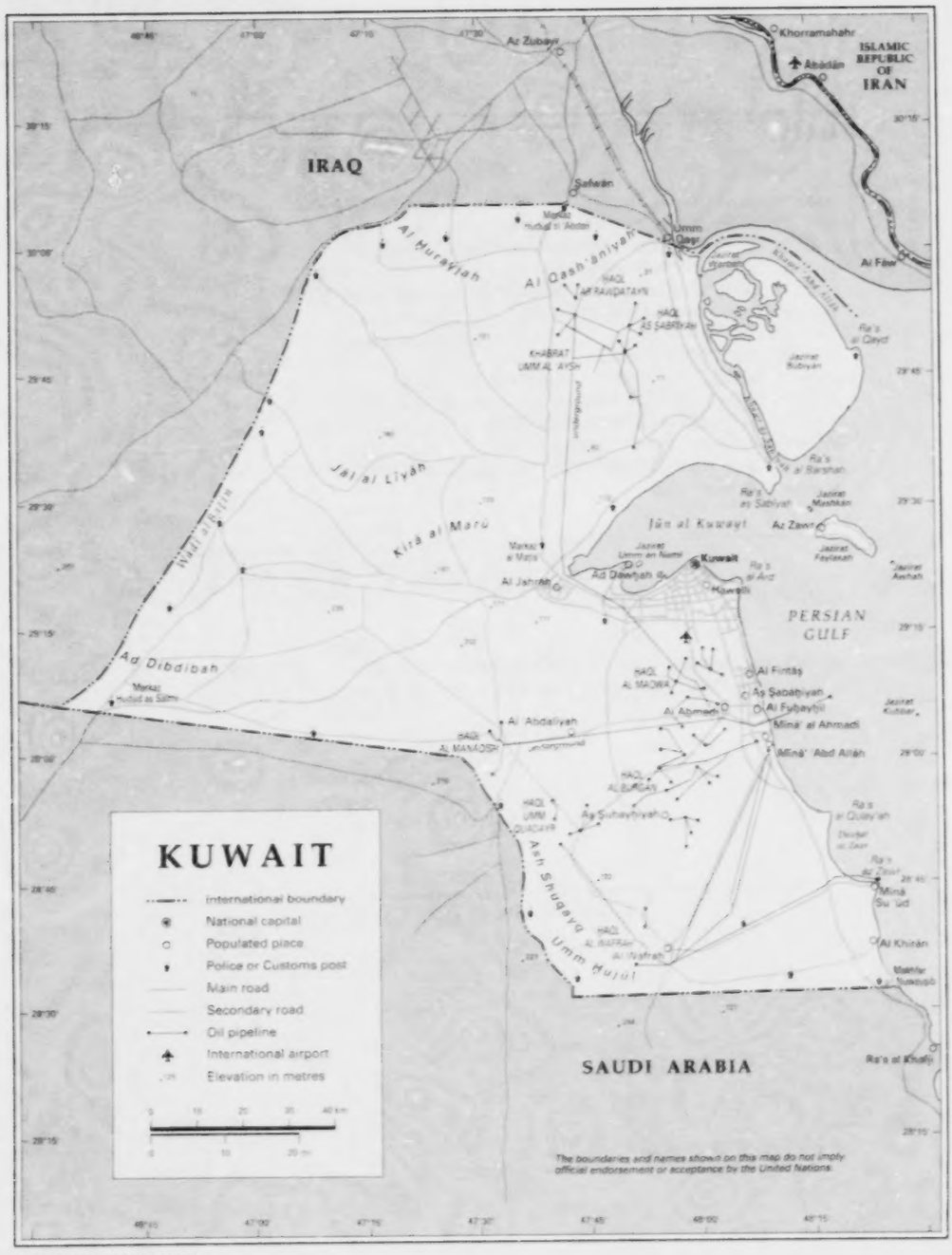


MAP NO. 3626 UNITED NATIONS
JANUARY 1991

INTRODUCTION

MANDATE AND COMPOSITION OF THE MISSION

1. On 6 March 1991, the Secretary-General decided to dispatch a United Nations mission to Kuwait with the following terms of reference:

a) To receive pertinent information from the Kuwaiti authorities, as well as non-governmental organizations (NGOs), for an assessment of the losses in life incurred during the Iraqi occupation of Kuwait;

b) To receive pertinent information from the Kuwaiti authorities, as well as NGOs, on Iraqi practices against the civilian population in Kuwait;

c) To assess the scope and nature of the damage that was inflicted on Kuwait's infrastructure during the period.

2. The present report is confined to the assessment of the damage to the infrastructure. The information called for in parts *a)* and *b)* of the terms of reference are the subject of a separate report (S/22536).

3. In his instructions to the leader of the mission, Mr. Abdulrahim Abby Farah, the Secretary-General emphasized the necessity of the mission proceeding without delay and, given the situation prevailing in Kuwait, that its report be completed as soon as possible.

4. Before leaving for Kuwait, Mr. Farah met in New York with the Acting Permanent Representative of Kuwait to the United Nations, Mr. Mohammad Saad Al-Sallal, and was provided with information that would enable the mission to identify specifically the areas and sectors on which the Government of Kuwait wished the mission to focus attention.

5. Sectoral work was assigned among the substantive members of the mission as follows: Mr. Cristian Ossa (Department of International Economic and Social Affairs of the United Nations Secretariat), macroeconomics; Mr. Michael Douglas Gwynne and Mr. Makram Gerges (United Nations Environment Programme (UNEP)), environment, agriculture and fisheries; Mr. John Beynon (United Nations Educational, Scientific and Cultural Organization (UNESCO)), education, culture and information; Dr. Daniel Tarantola (World Health Organization (WHO)), health; Mr. G. H. Connor (Department of Technical Cooperation for Development of the Secretariat), transport and municipal services; Mr. Ola Gunnes (Department of Technical Cooperation for Development), power and telecommunications; Mr. Kamal Mohamed Abou-Hamda, consultant for housing and urban infrastructure; and Mr. John Philip Thomas, consultant for oil industry, assisted by Mr. Johan Schölvinck (Department of International Economic and Social Affairs). Mr. Ramu Damodaran of the United Nations Secretariat served as Secretary of the mission. In view of the abnormal conditions in Kuwait and the absence of any United Nations back-up presence there, it was necessary for the mission to be assisted by a self-contained staff.

6. Members of the mission based in New York convened on 7, 8 and 11 March for preliminary consultations. In accordance with a programme drawn up in consultation with the Government of Kuwait, the main party reached Bahrain on 13 March, where they were joined by colleagues based elsewhere.

7. Logistical constraints made it necessary for the mission to spend two days in Bahrain before it could proceed to Kuwait. Fortunately, this provided an opportunity for senior members of the mission to be received by His Highness, the Prime Minister of Bahrain, Sheikh Khalifa Bin-Salman Al-Khalifa. Meetings were also held with His Excellency, the Foreign Minister of Bahrain, Sheikh Mohamed Bin-Mubarak, and the Minister for Information, Mr. Tarek Al-Moayyed. Discussions centred on the situation in Kuwait, its impact on the Gulf region and the role of the United Nations. The Government of Bahrain expressed its strong support for Kuwait and its determination to provide that country all possible assistance in the task of national reconstruction.

8. The mission reached Kuwait on 16 March by a special aircraft provided by the Government of Kuwait. It was received at the airport by His Excellency, Mr. Nasser Mohammed Al-Sabah, the Minister of State for Foreign Affairs of Kuwait, and other senior government officials. The same afternoon, the mission discussed its work programme with Mr. Abdullah Al-Dikheel, former Minister for Public Works of Kuwait, who had been designated by the Government as Mr. Farah's counterpart.

9. On 20 March, Mr. Farah was received by His Highness, Sheikh Saad Al-Sabah, Crown Prince and Prime Minister of Kuwait. The

Crown Prince expressed his country's deep appreciation to the Secretary-General for his prompt response to its request that a mission be dispatched to look into the question of damage sustained by Kuwait during the country's occupation by Iraq.

10. The mission completed its work in Kuwait on 4 April 1991.

GENERAL SETTING

11. The mission's mandate made clear that it should confine its study and assessment to the situation that prevailed in Kuwait during the period of occupation, that is, from 2 August 1990 to 26 February 1991. The complexity of the task confronting the members of the mission became apparent once it had the opportunity to witness for itself the realities on the ground and the abnormal conditions that had been created as a result of the occupation.

12. Before 2 August 1990, Kuwait was a society characterized by a highly capitalized, urban infrastructure. The mission arrived in Kuwait just two weeks after the return of the Government. It found itself obliged to begin its task in a country where the electric power, telecommunications and transportation systems had been wrecked, government buildings and other public institutions heavily damaged and most official records and equipment either destroyed or looted. Moreover, very few civil servants had resumed duty, and the vast majority were still outside the country.

13. Despite its acute shortage of senior and experienced staff, the Government did manage, in most cases, to assign counterparts to work with members of the mission in their respective areas of competence. This was particularly considerate since the stay of the mission occurred at a time when the Government was intensely occupied in restoring the administrative machinery and attending to the immediate needs of the people. Because of the staff situation, government counterparts were often called upon to fulfil other tasks while doing their best to assist the mission.

14. Members of the mission travelled extensively throughout the country, by land and by helicopter, making frequent and detailed visits to particular locations, sites and institutions essential to their task. The constraints of time and limitation of facilities necessitated the adoption of sample surveys in all sectors. The mission did not assess the damage sustained by defence infrastructure although it did observe damage to military airfields, barracks and defence installations.

15. Extensive contacts were maintained with members of the diplomatic community in Kuwait, with whom Mr. Farah held two meetings through the courtesy of the Ministry of Foreign Affairs of Kuwait. He also had talks with a number of ambassadors individually.

16. The mission wishes to record its appreciation of the contribution of a number of national and international agencies and groups who provided logistical support, as well as access to data, records and maps. In particular, it should like to mention the Embassies of France, the United Kingdom of Great Britain and Northern Ireland and the United States of America, as well as the Corps of Engineers and the 352nd Civil Affairs Command of the United States Army, the Explosives Ordnance Disposal Coordination Group of the coalition forces, the Environmental Protection Agency of the United States and the Kuwait Petroleum Corporation. Interaction between the mission and these, and other, organizations facilitated a sharing of assessments and ideas and an exchange of expertise, as well as cross-checking and verification of information obtained.

METHODOLOGY

17. Its terms of reference required the mission "to assess the scope and nature of the damage that was inflicted on Kuwait's infrastructure during the period". Since "infrastructure" has a broad meaning, the mission's assessment at the sectoral level has focused on three interrelated elements:

a) Permanent structures such as roads, ports, hospitals, educational institutions, factories, water plants and government and residential buildings;

b) Machinery, equipment and other support facilities, including stock, that enabled the structures to perform the functions for which they were designed;

c) Materials and software (e.g., books, archives, historical artifacts, research data) that were integral to the effective functioning of the service or activity of which they were a part.

18. The report comments on, and attempts to provide, a broad assessment of the impact of events during the Iraqi occupation on the welfare of the population of Kuwait, in particular on the social sectors, as well as on the air and marine environment and terrestrial ecosystems.

19. In the light of its initial findings, the mission also felt it necessary to comment on the extensive loss of output after 2 August 1990 as a result of the damage to the economy during the occupation, and on the nature and scale of the loss of goods, equipment and materials deriving from the deliberate destruction and organized looting and removal of property.

20. The mission was shown numerous sites where moveable property had been removed. According to testimony it received, such removal had been carried out by the Iraqi occupation authorities or on their specific order. Some instances reported to the mission appeared to be prima facie cases of looting, pillaging or plundering and these have so been described in the text. In other cases, property was not physically taken away but simply destroyed on site. In still other instances there is clear evidence of vandalism and ransacking. Accounts given to the mission during its survey attributed responsibility to the occupation forces in all such cases.

It was also explained to the mission that during the occupation a number of areas had been declared off-limits to Kuwaiti residents, thus facilitating the removal of goods without their knowledge.

21. While the seizure of some moveable property--particularly from warehouses, factories and plants—appeared premeditated and planned, at the shop or household level the pillaging of goods was said to have been carried out by individual Iraqi soldiers. In a number of cases the Iraqi authorities issued receipts to some institutions and factories from which goods had been taken, and even vouchers to be redeemed subsequently in Iraqi currency.

22. In reading the present report it should be understood that references to the removal of goods, in whatever manner, are intended to mean that they were removed by the Iraqi occupation forces either for their use in Kuwait or for transportation to Iraq.

23. Given the urgent and hence limited time-frame for the mission's work in Kuwait and the very difficult circumstances under which the assessment had to be undertaken, the mission decided to concentrate on the main sectors having a major bearing on Kuwait's economic activity—the oil industry, for example—or on those sectors that substantially affect the welfare of the population, such as health and the environment. The mission also examined the petrochemical and other manufacturing industries, electricity and water, agriculture, livestock and fisheries, sewerage and waste disposal, transport and communications, education and culture, housing and urban infrastructure, banking and commerce, as well as information and other services.

24. The mission established certain guidelines to achieve a uniform approach in all sectors. The approach involved the following steps:

a) An appraisal of the conditions of each sector before 2 August 1990, together with an identification of the central or core elements in each sector;

b) Preliminary discussions between the sectoral leaders of the mission and their Kuwaiti counterparts on current conditions in each sector and, in particular, possible damage inflicted on core elements during the period of occupation;

c) On-site inspection by the sectoral leaders of core elements and of other areas heavily affected, as well as an assessment of loss and damage to the infrastructure, machinery, equipment, support facilities, materials, etc.;

d) Cross-checking of information with government officials, national and international agencies, technical experts, in particular from the multinational forces (e.g., mine-clearing experts and United States Army Corps of Engineers), and, in relevant cases, executives from the Kuwaiti private sector;

e) On-site inspection of secondary elements (e.g., electrical substations, local health clinics) and geographical areas moderately damaged or undamaged. This was done on a selective basis, endeavouring to ensure adequate representativity. In a few cases, this was supplemented by a catalogue or inventory from the Kuwaiti authorities;

f) Discussions with the Kuwaiti authorities, sectoral representatives and other experts in the area to ascertain possible gaps in the assessment of damage and on-site inspection of gaps so identified.

25. Since the mission was not intended to provide, and indeed was not in a position to suggest, an exhaustive, quantified evaluation of damage, the sectoral assessment involves only a characterization of the damage and an indication of its extent. The latter is assessed, wherever possible, in percentage terms. For most estimates, the margin of error is plus or minus 10 per cent.

26. Particular difficulties arose in making accurate assessments of the current inventory of raw materials, spare parts, finished goods and equipment, as well as of intellectual and cultural property (books, archives, historical artifacts, research data, notes and texts) in the various institutions and facilities visited.

27. Since most files were destroyed or removed, it will be particularly difficult for the public and private sectors to reconstitute the lists of their inventory at the time of the invasion. Similarly, it will be some time before exact lists can be established of assets that remained after the withdrawal of the occupation forces, since few, if any, institutions or factories show any semblance of normal functioning. Many facilities are wholly deserted and in those cases where some staff have reported for work, they are primarily engaged in the most basic tasks of restoring a semblance of order by sifting through the few remaining documents.

28. The mission visited many premises, inspecting storage rooms and warehouses of each institution in order to verify conditions at the time of its visit. The mission's awareness of the inventory normally required for the proper functioning of the various facilities helped it to gain a good idea of the extent of the losses. It should be borne in mind that Kuwaiti institutions, because of the relatively generous availability of resources, were often in a position to keep large stocks of supplies in hand.

29. Four categories were used to quantify damage or loss of assets: a) less than 20 per cent, slight damage or slight loss; b) 20 to 50 per cent, moderate damage or moderate loss; c) 50 to 80 per cent, heavy damage or heavy loss; and d) 80 to 100 per cent, completely damaged, total destruction or total loss. The corresponding categories used in the environmental assessment were: light; moderate; severe; very severe. In the case of major infrastructure items, a brief description of the damage to each item has also been included in the text.

30. In surveying the damage to the infrastructure in Kuwait, the mission took into account the fact that some areas, sites and locations in the country had been the scene of armed conflict and engagement, while others had been the target of military action by one side or the other. This was particularly the case with airfields and telecommunication installations. However, the overwhelming majority of sites visited and inspected by the mission suggested damage that was not war-related but the result of wanton and deliberate acts, some intended to destroy specific national assets and vital services.

31. The basic approach to the assessment of the environment was essentially the same as in other sectors. None the less, it is important to highlight its special features. First, it was broad-based, covering all the geography of the country, including coastal areas and environment-related sectors, such as agriculture, livestock and fisheries. Secondly, environmental conditions were still changing rapidly, with further deterioration in some areas and improvement in others. Thus, the mission tried to collect all data on environmental conditions compiled from different sources since the withdrawal of the occupation forces, including data and measurements that were becoming available on an almost daily basis while the mission was in Kuwait.

1

FROM AN ECONOMIC POINT OF VIEW, NO LESS THAN FROM AN ENVIRONMENTAL PERSPECTIVE, THE GREATEST DAMAGE WAS THAT INFLICTED ON THE OIL INDUSTRY. THE DESTRUCTION OF REFINERIES AND PIPELINES AND STORAGE SYSTEMS AND, ABOVE ALL, THE FIRING OF MORE THAN 600 OIL WELLS HAS BROUGHT UNPRECEDENTED CATASTROPHE TO THE ECONOMY AND THE ENVIRONMENT OF KUWAIT.

1 ECONOMIC AND SOCIAL CONDITIONS IN MID-1990 AND EARLY MARCH 1991

SITUATION BEFORE 2 AUGUST 1990

32. In mid-1990, the population of Kuwait was 2.1 million, of whom about 800,000 were Kuwaiti citizens. More than half of the population was under 25 years of age. Well over 90 per cent of the total population lived in urban areas along the coast, giving the whole country a metropolitan character. Life expectancy for men was 71 and for women 75 years, with an infant mortality rate of the order of 15 per 1,000. Kuwaiti citizens enjoyed a developed welfare system backed by a well-equipped infrastructure.

33. Education, including secondary education, was provided free to both Kuwaitis and non-Kuwaitis. Health services were also virtually free and of quite a high standard, as was housing, which was heavily subsidized for the low- and middle-income groups of the population.

34. Per capita income amounted to about $US 14,700, while the per capita gross domestic product (GDP) amounted to $11,600 in 1989. The difference was due to large revenues in the form of interest and dividends from accumulated investments abroad. Crude oil production and related activities made up for a large part of total output: 40 to 50 per cent of GDP.

35. The economy had remained fairly vulnerable to oil prices in international markets, since petroleum and petroleum products accounted for 90 per cent of total exports. It had, however, continued to expand, albeit modestly, in the 1980s. The rate of inflation during this period was remarkably low.

36. A cautious balance-of-payments policy and a very large export sector ensured a steady surplus in the balance on current account, leading to increased investments abroad and a strong dinar. Between 1985 and 1989, average annual exports of goods and services amounted to $8,800 million and imports to $4,670 million. According to International Monetary Fund (IMF) figures at the end of June 1990, the level of total reserves minus gold had reached $2,128 million and gold reserves stood at 2.5 million fine troy ounces.

37. The share of gross fixed capital formation in GDP, a major determinant of the potential for economic growth, could be compared to that of States members of the Organization for Economic Cooperation and Development (OECD): slightly below 20 per cent in the late 1980s. The investment level in 1989 was close to $5 billion. Government policies and the comparatively high investment rates led to a gradual diversification of the economy, despite the enormous potential of the oil industry. Indeed, the country's proven recoverable oil resources were quite high in mid-1990. They had been estimated at 94,500 million barrels, which measured the equivalent of about 200 years of output at a rate of 1.3 million barrels a day.

38. The steady stream of oil export revenues allowed the country not only to attain a high level of material prosperity, but also to channel a large volume of resources through the public budget. In the 1988/89 budget, expenditures reached $11 billion, mainly for industrial diversification, the increased provision of social services and the gradual establishment of a major reserve fund for future generations, as well as aid to low-income developing countries. In fact, in relation to its GDP, Kuwait was among the international community's largest aid donors in the 1980s.

39. In the late 1980s, annual per capita public expenditure in education and health was about $500 and $350 respectively. The number of university graduates was growing at a rate exceeding 8 per cent a year—twice the rate of growth of the population. The number of graduates in petroleum engineering, medicine and allied health services was growing at an even more rapid pace.

40. In brief, Kuwait, in mid-1990, had a solid balance-of-payments position, public finances were under control and the process of industrialization and improved development of human resources was proceeding apace. Economic instability was still somewhat inherent in the development process of the country because of the volatility of oil prices and the unusually high reliance on migrant labour. However, Kuwait had a functioning economy and was clearly poised to attain even higher living standards and still greater social development in the years ahead.

CONDITIONS IN MARCH 1991

41. The invasion of Kuwait in August 1990 brought about a dramatic change. By the end of Iraq's occupation on 26 February 1991, the outlook had been radically transformed. Kuwait City, previously a modern, urban centre with thriving bazaars and a busy commercial district, had become a ghost town. The same was true of other urban areas across the country, where major social dislocations had occurred during the occupation of the country: two thirds of Kuwaiti nationals had sought refuge abroad; three quarters of the labour force had been obliged to leave Kuwait; and the quality and availability of health services had been dramatically downgraded and education had come to a halt.

42. The effect of the occupation on Kuwait's economic and commercial life was even more devastating. Managerial capacity to run corporate activities and carry out government tasks had been depleted. The occupation authorities, through a web of administrative and financial restrictions, had prevented the few executives who had remained in Kuwait from taking any initiative.

43. The physical infrastructure supporting basic services—electricity, water, waste disposal—had been rendered inoperative; ports largely destroyed; oil production and refining and related offloading activities crippled; the financial system severely disrupted; foreign trade suspended; commerce considerably diminished; manufacturing paralysed; and inventories plundered. The marine environment had been severely affected by the flow of crude oil into the Persian Gulf, while the beautiful waterfront in Kuwait City had been devastated and its entire beach turned into a minefield.

44. From an economic point of view, no less than from an environmental perspective, the greatest damage was that inflicted on the oil industry. The destruction of refineries and pipelines and storage systems and, above all, the firing of more than 600 oil wells had brought unprecedented catastrophe to the economy and the environment of Kuwait. Moreover, numerous mines laid by the occupation forces continued to pose a persistent threat to human lives.

45. At the time of the arrival of the mission in mid-March 1991, economic, social and environmental conditions bore no resemblance to the situation that prevailed only eight months earlier.

46. The fall in aggregate output and the losses of income were staggering. The decrease in Kuwait's GDP between early August 1990 and late February 1991 was more than 70 per cent. Capital formation came to a halt as virtually all new projects, and projects under implementation, were stopped.

47. Even an enormous drop in output and investment paralysis can be a transitory phenomenon. In Kuwait, however, the widespread destruction of capital assets and the supporting infrastructure, as well as the looting of equipment and inventories, could only make recovery difficult and protracted. Output losses remained quite substantial in March and will continue to be very large in the coming months.

48. Despite the unprecedented economic setback and social dislocation, the mission witnessed some significant improvements during the short period it was in Kuwait. Electric power and telephone services had been restored to parts of the country and food and other essential goods were becoming increasingly available. A few retail shops that had escaped damage had been opened and street vendors had appeared. But the essential process of repair and rehabilitation was still very much at its initial stage. Succeeding generations will continue to be endangered by unexploded ordnance, particularly mines. The physical infrastructure could well require a great part of the present decade to recover. The harm to the population from a polluted environment, although not easily identifiable today, may become manifest in a pervasive way only with the passage of time. Plans for the restoration of social and administrative services are being formulated on an urgent basis. But it will take months, even years, before the country recovers from the damage and losses inflicted by the Iraqi occupation.

2

... BY NO MEANS THE LEAST IMPORTANT IS THE RANGE OF UNQUANTIFIABLE LOSSES ARISING FROM THE DOWN-GRADING OF HEALTH FACILITIES, THE DEPLETION OF THE NATIONAL CULTURAL HERITAGE, THE IRREPLACEABLE SCHOOL YEAR LOST TO ALL STUDENTS AND, OF COURSE, THE DEGRADATION OF THE ENVIRONMENT. NOT ONE OF THESE CAN EVEN REMOTELY BE ASSESSED IN FINITE FIGURES BUT THEIR IMPACT WILL BE FELT BY KUWAIT FOR GENERATIONS TO COME.

2 SUMMARIZED ASSESSMENT OF MAJOR DAMAGE

49. As explained in the introduction to the present report, the mission carried out a very broad assessment of the damage inflicted on the economy of Kuwait as the result of the country's occupation by Iraq.

50. Based upon data presented by the Kuwaiti authorities, as well as on estimates made by expert members of the mission, it was possible to arrive at a very broad approximation of damage and loss sustained in several areas. A summary quantification is presented below.

51. The GDP of Kuwait was of the order of $24 billion in 1989. The invasion led to a virtual paralysis in many economic activities and a major reduction in the delivery of service. The corresponding loss in output, and consequently income, amounted to about $10 billion between August 1990 and February 1991.

52. The rehabilitation of the oil industry, including the capping and control of oil wells, the repair of gathering centres and the reconstruction of refineries is expected to exceed $5 billion. In addition, nearly 4 million barrels were being lost daily at the time of the mission's visit. This loss will accumulate until the wells are controlled and capped.

53. Critical parts of the electrical generating capacity and also part of the distribution grid were destroyed during the occupation. The cost of restoring the electrical system to the standard prevailing before the invasion will be of the order of $1 billion.

54. The damage suffered by the transport infrastructure was heavy in the case of ports and harbours. The national airport also suffered major damage. Air transport services not only sustained damage to their facilities they also experienced a major theft in equipment. The overall losses sustained by ports, the airport and the national airline amount to more than $2 billion.

55. The country's road transport fleet, including private and public vehicles, needs to be restored to its former level. The occupation resulted in at least half of the country's transport fleet (buses, long-haul vehicles, tankers, trucks, cars, etc.) being lost, either by their appropriation and removal from the country or by destruction. Restoring the fleet to its former level of 560,000 vehicles is estimated to cost over $5 billion.

56. The country's satellite system and the internal telephone and telecommunications network will need a considerable amount of replacement equipment and will take some time to repair. It is estimated that $1 billion will be required to bring these essential services back into full operation.

57. In the case of radio, television and press services, another $500 million will be required to rebuild damaged transmitter stations, to replace the powerful transmitters that were either removed or destroyed and to re-equip studios, control rooms and printing establishments.

58. It is difficult to estimate the cost to the housing sector since the losses were not so much the result of structural damage as of ransacking and vandalism that were inflicted on a great number of houses, particularly those that were unoccupied during the seven-month period. At a conservative average figure of $15,000 per dwelling unit, it is estimated that total losses to 170,000 housing units will be approximately $2.5 billion.

59. The reconstruction and refurbishing of two large resort complexes and of 800 rooms in damaged deluxe and first-class hotels will exceed $100 million. The group of hotel owners contacted has made an estimate of $100,000 per room, which includes the restoration of restaurant and catering areas, equipment and all other facilities.

60. To rebuild, repair and refurbish other urban infrastructure, major expenditures will need to be incurred. To restore government buildings, including the National Assembly, and to repair the waterfront, reconstruct the International Trade Fair and rehabilitate the sporting clubs and other recreational facilities, at least $500 million will be required.

61. In the banking sector, Kuwait will need to recover valuables taken from a very large number of commercial banks. Moreover, 1.3 million troy ounces of gold valued at close to $500 million were removed from the Central Bank.

62. The looting of wholesale and retail establishments was massive and spared virtually no commercial centre, warehouse or large store. Estimates in this area can only be very tentative, yet losses (excluding vehicles) could easily approach $1 billion.

63. The damage to the petrochemical industry and other manufacturing activities was large and often characterized by the complete removal of modern machinery and equipment and the looting of inventories (raw materials, spare parts and finished products). Owing to the very large number of affected industrial establishments, an accurate quantification will take considerable

time. However, an amount of damage bordering on $1 billion appears reasonable.

64. The above estimates do not cover all damage sustained. Destruction of installations and considerable losses of equipment were sustained in other sectors, in particular education and health, as well as the road network and maintenance equipment, water supply and garbage disposal systems, agricultural stations and fisheries.

65. Moreover, in a number of areas surveyed by the mission there was damage or "hidden losses" whose precise scale and nature were not evident on the surface but which, nevertheless, might represent a further erosion of Kuwait's infrastructural base. These include damage resulting from inadequate care and maintenance, the rusting and disintegration of metal components, the solidification of liquids or extraneous materials obstructing or blocking pipes and ducts in refineries, industrial plants and public utilities. Among the most important of the unassessed losses is the damage to the oil reservoirs. None of these could be assessed at the time of the mission's visit.

66. Related to this is the continuous loss in output, and consequently of income. In March 1991, the economy remained at a standstill. To return to production levels prevailing in early 1990, let alone to surpass them, would require not only enormous investments of money but also manpower.

67. Finally, but by no means the least important, is the range of unquantifiable losses arising from the down-grading of health facilities, the depletion of the national cultural heritage, the irreplaceable school year lost to all students and, of course, the degradation of the environment. Not one of these can even remotely be assessed in finite figures but their impact will be felt by Kuwait for generations to come.

3

AFTER ALMOST SEVEN MONTHS OF OCCUPATION . . . KUWAIT'S OIL INDUSTRY WAS REDUCED TO A SHAMBLES . . . MANY [OIL WELLS], WHICH WERE NOT ON FIRE, WERE GUSHING TENS OF THOUSANDS OF BARRELS OF OIL EACH DAY, FLOODING THE DESERT AND CREATING LAKES AND RIVERS OF OIL.

3 OIL INDUSTRY

AN OVERALL VIEW

68. Kuwait's petroleum industry (see map 2) was a fully vertically integrated operation covering all facets of exploration, drilling, production, refining and marketing, both domestically and internationally.

69. During the occupation of Kuwait, much of the country's petroleum industry was pillaged and sabotaged. The latter is perhaps most graphically evidenced by the hundreds of fires that were set off by the blowing up of the oil wells.

70. The mission's assessment of the damage takes into account not only the degree of destruction but also the interdependence and interrelationship of each separate and distinct function of the petroleum industry. In order to facilitate the understanding of the nature of its vertical integration, two block flow schematics are reproduced at the end of the present section. Figure 1 depicts the petroleum production network and figure 2 shows the gas production network.

CRUDE OIL PRODUCTION FACILITIES

Situation before 2 August 1990

71. At the beginning of 1990, Kuwait's oil wells had an installed capacity of 2.9 million barrels per day with maximum technically sustainable capacity of 2.5 million barrels per day. According to some estimates, this latter figure could have been increased to 4 million barrels per day within 24 to 36 months. Proven reserves stood at 94,525 million barrels by the end of the 1980s (or about 130 years of production at a rate of 2 million barrels per day).

72. At the time of the invasion, crude oil production in Kuwait amounted to about 1.5 million barrels per day. Crude oil production and associated offloading facilities were carried out by the Kuwait Oil Company (KOC), a subsidiary of the Kuwait Petroleum Corporation (KPC).

73. There are four areas in Kuwait that are in use for producing crude oil: north Kuwait, west Kuwait, south-east Kuwait and Wafrah. The first three areas are wholly owned and operated by KOC, while the crude oil production in the Wafrah area was shared equally by Kuwait and Saudi Arabia.

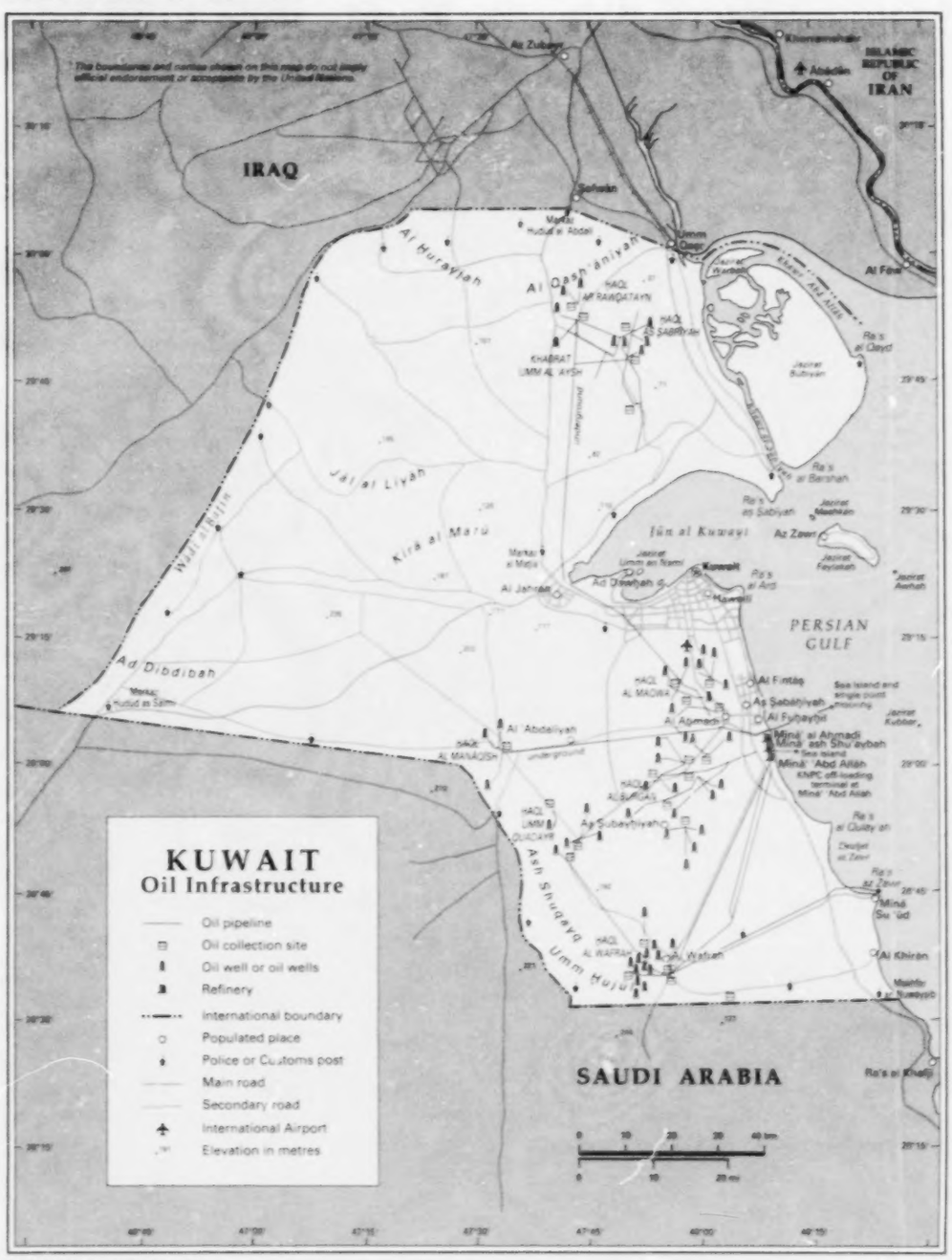
74. North Kuwait consisted of four fields with 316 wells and produced 400,000 barrels per day. West Kuwait contained three fields with 134 wells and produced 150,000 barrels per day. South-east Kuwait was the "jewel in the crown" of Kuwait's oil production and contained the multi-reservoir Greater Burgan field, the second-largest oilfield in the world. There were 661 wells in south-east Kuwait and it produced 1.1 million barrels per day. Of the total of 1,111 wells in these three areas, 980 were in production on 1 August 1990. Of the 900 wells in the Wafrah area, 350 were active and produced between 170,000 and 180,000 barrels per day. Half of Wafrah's production was transported through underground pipelines to a refinery at Mina Az Zawr, which is owned and operated by Texaco for the benefit of Saudi Arabia. Part of the other half (heavy crude or eocene) went by underground pipelines to the refinery at Mina Abd Allah, but was processed at the Al Ahmadi refinery. The rest was normally stored in tanks at Ahmadi town.

75. Wafrah differs from the other three areas in that there was very little pressure in its fields and in many instances oil was pumped out by means of suckerrod pumps. As a result of the pressure in the other three fields, oil and the associated natural gas flowed freely through surface gathering lines to gathering stations for processing.

76. After separating the oil and gas, the oil was conveyed by underground pipelines and manifolds to two storage tank farms at Ahmadi, which had a combined storage capacity of 14 million barrels. The tank farms are located 120 metres above sea-level, which made it possible for the oil to flow by natural gravity through an intricate system of manifolds and underground pipelines to Kuwait's three refineries at Mina al Ahmadi, Mina Abd Allah and Mina Shuaiba as well as to its crude offloading facilities at Mina al Ahmadi and, through marine pipelines, to an offshore sea-island and a single point mooring facility.

77. On 1 August 1990, KOC was operating a modern, sophisticated crude oil production system requiring highly developed

MAP 2



MAP NO. 3631.1 UNITED NATIONS
APRIL 1991

managerial and engineering skills and employing some 5,000 people. Its crude oil exports alone (excluding export of refined products) generated about $13 million per day for the Kuwaiti economy.

Assessment of damage

78. After almost seven months of occupation, this prosperous situation dramatically changed. Kuwait's oil industry was reduced to a shambles. Excluding the Wafrah area, there were 980 active crude oil and associated natural gas producing wells. Of these, some 550 were in flames. Many other wells, which were not on fire, were gushing tens of thousands of barrels of oil each day, flooding the desert and creating lakes and rivers of oil. If one takes into account the Wafrah area, the total number of active wells increases to 1,330, of which approximately 700 were on fire at the time of the mission's visit.

79. Estimates vary, but there is general agreement that from 2 million to 6 million barrels are lost in this manner each day. On the basis of $20 per barrel, this represents a loss ranging from $40 million to as much as $120 million each day. As a result of the occupation and the consequent loss of production during the period, Kuwait suffered an additional loss of $8.5 billion.

80. Today, no production of crude oil is possible, and it may take as much as 12 to 18 months to bring all the burning and gushing wells under control. Efforts to extinguish the fires have been initiated. These efforts are being helped by four undamaged underground pipelines leading from the tank farms to the Persian Gulf, which can be used to pump sea water to the oil fields in a reverse flow mode. This process will save considerable time, money and effort. As soon as the reverse flow pumping system is in place, the fire-fighting effort can start.

81. Since the end of March, three fire-fighting teams have arrived in Kuwait. By the end of May, 15 to 18 teams are expected to be in place. The operation would cost approximately $45 million to $50 million per month. Consequently, bringing all wells under control is estimated to range from $600 million to $850 million, or about $1 million to $1.5 million per well.

82. It is extremely difficult to establish the exact number of wells damaged as a number of areas have not been declared safe to enter because of mines and ordnance. However, taking the situation in the Maqwa and Al Ahmadi fields (both surveyed by the mission by helicopter and located in the Greater Burgan field) as a guide, only 5 out of 239 wells were free of damage. In addition, as the fires continue to rage out of control, major damage may be inflicted on the reservoirs. A number of wells are already yielding water mixed with oil and gas, turning the smoke from black soot to a grey mixture of soot and steam. Wells undergoing this process may be rendered useless for future production and the drilling of replacement wells, expensive remedial drilling techniques or other types of rehabilitation may be required to recover the oil. Furthermore, pressure in the reservoirs is also diminishing, thereby lessening considerably the ease by which the oil is currently produced.

83. In order to determine the extent of the damage to the reservoirs, simulation models must be developed. Fortunately such models have been made in the past for all KOC oil fields. It appears that they can be readily adapted for analysing the present production problems that may exist at the wells. In the event of wells having to be replaced because of irreparable damage, the average cost of completely restoring a shallow well (3,400-9,000 feet) would amount to up to $1.5 million and for a deeper well (9,000-15,000 feet) up to $5 million. Most of the wells in the Greater Burgan and Wafrah fields are shallow, ranging in depth from 3,400 to 4,700 feet, while in the northern and western fields they range from 7,500 to 11,000 feet.

84. At the same time there are 681 wells (550 in the Wafrah area and 131 in the other three areas) and gathering stations that are basically intact and could be brought on stream rather quickly, thus making it possible to produce as much as 50,000 barrels per day within two months and as much as 150,000 barrels per day within six months. These production rates are contingent upon the removal of other bottlenecks downstream from the wells but they are, of course, well below those prevailing before the occupation.

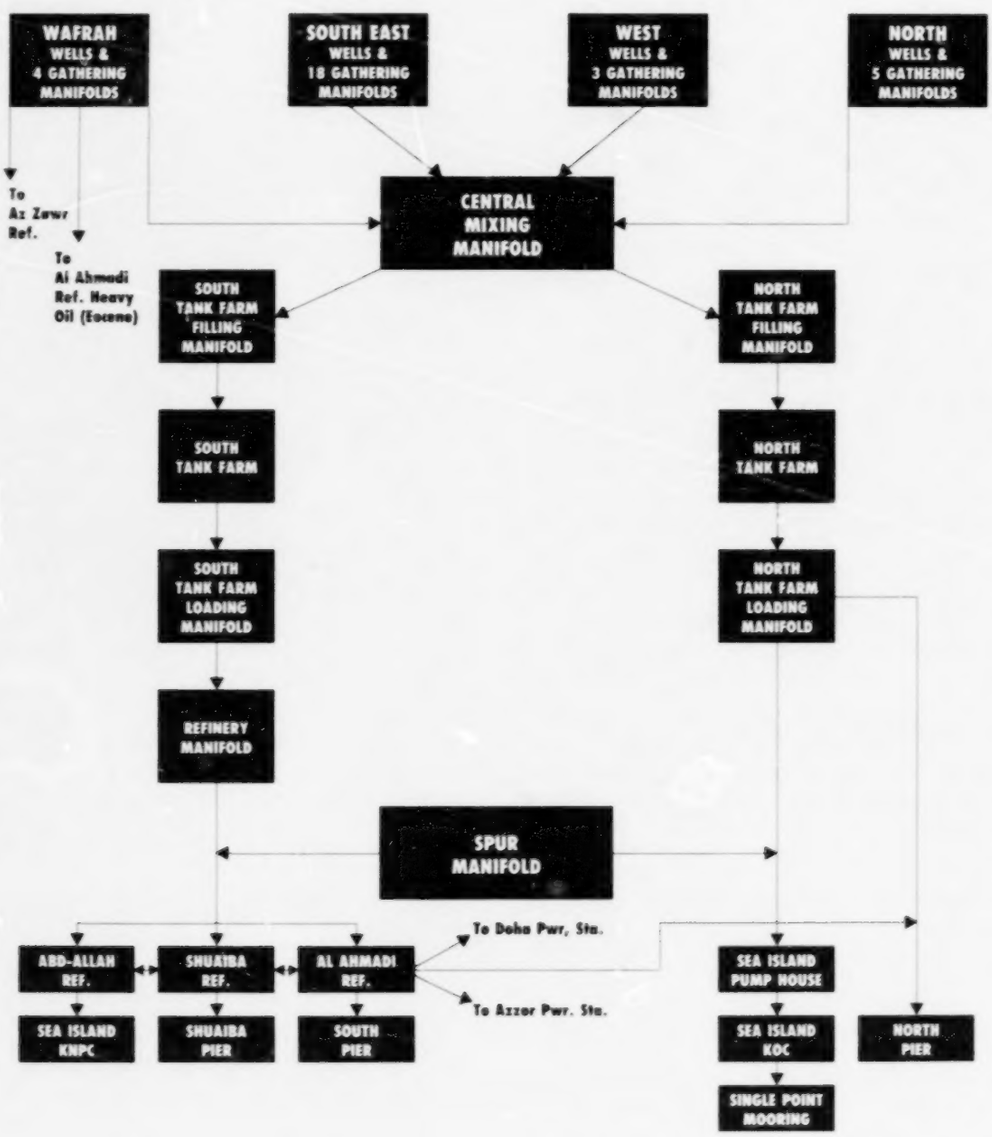
85. The upstream facilities of KOC, consisting of 26 gathering stations (excluding 1 main station and 23 substations at Wafrah), which separate the oil and gas at the well areas, were heavily damaged or destroyed. Of the 26 stations, which cost about $200 million each, the condition of only half could be ascertained since smoke, fire, mines and ordnance precluded visits on foot or surveys by helicopter. Eight of the 13 stations surveyed were severely damaged; 1 of these, located near the crest of the Greater Burgan field, where the smoke and fire conditions are infernal, can be considered representative of another 7, making a total of 15 that are highly likely to have sustained severe damage. Of the remaining five stations visited, three are out of commission because either their tanks or control rooms have been destroyed; at one of the stations, one tank was on fire and the other was slightly damaged. In general, it appears that at least a minimum 31 to 58 per cent of the stations were severely damaged (for a total loss of between $1.6 billion and $3.0 billion) and 12 per cent cannot be operated.

86. The mission's inspection showed that the downstream facilities of KOC also incurred heavy damage. They consist of various manifolds, two tank farms (north and south), pipelines to the refineries and offloading facilities, as well as the crude export facilities.

87. The central mixing manifold was heavily damaged but the filling manifolds for the south and north tank farms are intact. Damage to the two tank farms is major. Of the 35 tanks comprising the south tank farm, with a total storage capacity of 6 million barrels, 14 tanks were destroyed and 2 were damaged, for a lost capacity of about 3.3 million barrels, or 55 per cent. The south tank farm is mostly used to service the refineries but it is also connected to the north tank farm and the crude export facilities through a spur manifold. Of the 24 tanks that comprise the north

FIGURE 1

PETROLEUM PRODUCTION NETWORK



tank farm, with a total storage capacity of 8 million barrels, 8 tanks were destroyed and 1 was damaged, for a lost capacity of about 3.7 million barrels, or 46 per cent. The north tank farm is basically dedicated to offloading crude for export. The two loading manifolds, which are downstream from the tank farms, were said to have been destroyed by Allied precision bombing in an effort to stem the flow of large quantities of crude oil that was being released into the Persian Gulf.

88. From the above it becomes clear that the KOC operations have been strangled: no oil can enter into its system and no oil, even if it were available, can leave it. The stranglehold is aggravated by the destruction at the crude export facilities. To make matters worse, the time required for rehabilitation will be lengthened since most of the KOC employees fled Kuwait during the occupation, leaving a minimal workforce of about 1,400 people, or only 28 per cent of its normal level.

OIL REFINING

Situation before 2 August 1990

89. On the eve of the invasion, Kuwait was producing about 750,000 barrels per day of refined products, most of it for export. The refineries and associated export facilities were operated by the Kuwait National Petroleum Company (KNPC), a subsidiary of KPC.

90. There are three refineries in Kuwait operated by KNPC: Mina al Ahmadi, Mina Shuaiba and Mina Abd Allah. A fourth one, at Mina Az Zawr, is operated by Texaco but owned by Saudi Arabia to process its share of the crude coming from the Wafrah area. All four are on the coast but only the three KNPC refineries are adjacent to each other. The latter three are connected through inter-refinery transfer pipelines and only a short distance from the crude oil facilities of KOC at Ahmadi. Their combined refining capacity amounts to about 820,000 barrels per day. In addition, the upgrading of their operations for higher grade products has led to the production of elemental sulphur (total capacity 2,350 tons a day), all of it for exports (at about $70 a ton).

91. Mina al Ahmadi, although dating from the late 1940s, has continuously been upgraded and has a total refining capacity of 390,000 barrels a day. It consists of three parts. The oldest section was revamped in 1970 and has a capacity of 120,000 barrels a day. The second section, following the refinery modernization project, was put into operation in 1984 and has a capacity of 170,000 barrels a day. The newest section was put into operation in 1986 following the further upgrading project and has a capacity of 100,000 barrels a day. The expansions of 1984 and 1986 were undertaken in order to produce higher grade products for export, such as lead-free gas and jet fuel.

92. Mina Abd Allah dates from the late 1950s but was entirely upgraded in 1987, including the installation of a sophisticated computerized central control system for the whole refinery. Besides a refined products capacity of 235,000 barrels a day, it also has a coker unit with a capacity of 2,200 tons a day. Mina Shuaiba was built in 1968 and was upgraded in 1978 from 90,000 barrels a day to a capacity of 195,000 barrels a day. Although it is the most recent vintage of the three refineries, it is at present the oldest one in terms of overall plant and equipment. It was in the process of being further improved and a central control system, similar to the one in Mina Abd Allah, was almost completed.

93. On 1 August 1990, KNPC was running a dynamic, fully integrated state-of-the-art refining operation employing about 7,200 people. It was generating some $20 million a day for the Kuwaiti economy. By the middle of 1990, exports of refined products and crude oil together represented more than 90 per cent of Kuwait's total exports.

Assessment of damage

94. The mission inspected the KNPC refinery operations, which, like the crude-oil production facilities, were paralysed. No crude oil was able to enter the refineries. In any case, the refineries themselves had been damaged, albeit to varying degrees, thereby making processing impossible. The refinery at Mina Az Zawr, operated by Texaco, had been entirely destroyed.

95. All three KNPC refineries were closed down on 2 August 1990 in an extremely hurried manner. However, the refinery at Mina al Ahmadi was brought back on line sometime during September 1990, reportedly in order to satisfy Iraqi military requirements and local demand, mainly for petrol. Only the revamped old section of the refinery was used for this purpose and production averaged about 75,000 barrels a day until mid-January 1991, when the plant was closed down once again.

96. The overall damage to Mina al Ahmadi is relatively slight. The control room for the crude distillator unit—which is the first and foremost essential process in any refinery—in the old section of the refinery was slightly damaged and some collateral damage was inflicted to the tower of the unit. An attempt was made to blow up the control room for the reformers (which are used to make lead-free and high-octane petrol) but the control panels escaped basically unscathed. The crude distillator unit in the refinery's further upgrading project was slightly damaged but appears operational. Minor damage was incurred by 10 of the 140 storage tanks for refined products. Two were blackened by fire and the remaining 8 exhibited bullet holes; all 10 can be repaired, however.

97. Mina Abd Allah suffered considerably more damage. Although the intricate refining components of the plant remained largely untouched, three important parts were destroyed. Foremost among these is the central control room or the nerve centre of the refinery, which was completely devastated by explosive charges. The control room contained state-of-the-art computer equipment (estimated at $150 million), including a PMX3-45,000 computer and a TDC-3,000 control system, and ran the operations of the refinery through an advanced control strategy soft-

ware system. Not only was all the hardware destroyed, but the software, including its back-up copy, perished as well. There are, however, 8 to 10 satellite control rooms for various operating units of the refinery. It is at present unknown to what extent these are damaged as clearance for visiting them has not yet been given by the explosives ordnance disposal teams. Their outward appearance indicated no major damage. If they are in good condition, they could substitute for the central control centre. Without this knowledge, however, the refinery remains crippled.

98. The refinery is further strangled by the complete destruction of both a 20,000 horsepower pump house and its associated substation, which was used for pumping the refined products to the KNPC sea-island for exports, and the so-called inter-refinery transfer pump house for pumping the products to the other two refineries. Large sections of the pipelines to the KNPC sea-island and the inter-refinery transfer pipelines were destroyed.

99. Besides this destruction, other major damage was done to the following:

a) The coke emergency storage room (capacity: 20,000 tons), in which about 7,000 to 10,000 tons of coke are smouldering owing to the lack of electricity required to operate the water cooling system (100 per cent loss at $60 a ton);

b) The coke conveyor belt system, of which about 2 kilometres, out of a total length of 3 kilometres, was destroyed by fire, making the offloading of coke virtually impossible;

c) One of the three water-treatment skimming ponds;

d) The fire pumps at the small boat harbour;

e) The local control room for the two destroyed pumping houses. The 68 product storage tanks (total capacity about 15 million barrels) incurred less severe damage: of the 6 tanks damaged, 4 had their floating-roofs sunk and 1 had its floating-roof blown off.

100. Mina Shuaiba incurred damage to its only crude distillator upon which production of refined products is dependent. The tower of the unit also appears to have been severely damaged and burnt. The nearby overhead pipelines for transporting products were destroyed over a length of about 70 metres. The isomax unit, which yields petrol and diesel fuel, was also heavily damaged and an electric substation that services a number of units was completely blown up, causing some collateral damage to an isocracker, a compressor and an emergency generator. It should be noted that the damage may be superficial. Consequently, a full assessment of the damage to the units can be undertaken only once an attempt has been made to start them up again.

101. The product storage tanks at Mina Shuaiba were also damaged. Of the 84 tanks (total capacity 12 million barrels), 5 were completely destroyed, for a total lost capacity of 1.26 million barrels. Nineteen other tanks were damaged to varying degrees by bullets and shells reportedly fired by Iraqi soldiers for target practice. One tank is riddled with bullet holes and may be unusable.

102. Even though some of the visible damage to the refineries may be superficial, the invisible internal damage may be major. The refineries at Mina Abd Allah and Mina Shuaiba were shut down within a few hours and the normal close-down procedures, which usually take about a week, could not be carried out. This may have caused major damage to equipment, catalysts, pipes, brickwork, pumps and vessels, and could result in costly repair and delays in restarting operations. Furthermore, a refinery lying idle for a considerable amount of time may develop problems even if it has not been damaged. It was impossible to appraise this likely damage because the refineries had neither power nor crude oil to start up production at the time of investigation.

103. Today, the KNPC operations, like those of KOC, are at a standstill. No refining is possible because no crude oil can reach the refineries. In any case, at least two of the three refineries cannot be operated because of the destruction or damage caused to their vital components. Furthermore, even if refining were possible, export would not be practicable since all offloading facilities from the three refineries were wrecked. Consequently, Kuwait not only lost revenues from its oil refining operations during the seven months of occupation, but it will continue to do so until all the numerous obstacles and bottlenecks have been removed. One immediate obstacle is the lack of human resources at the KNPC operations. Today only about 700 employees, or less than 10 per cent of the original workforce, are present.

GAS INDUSTRY

Situation before 2 August 1990

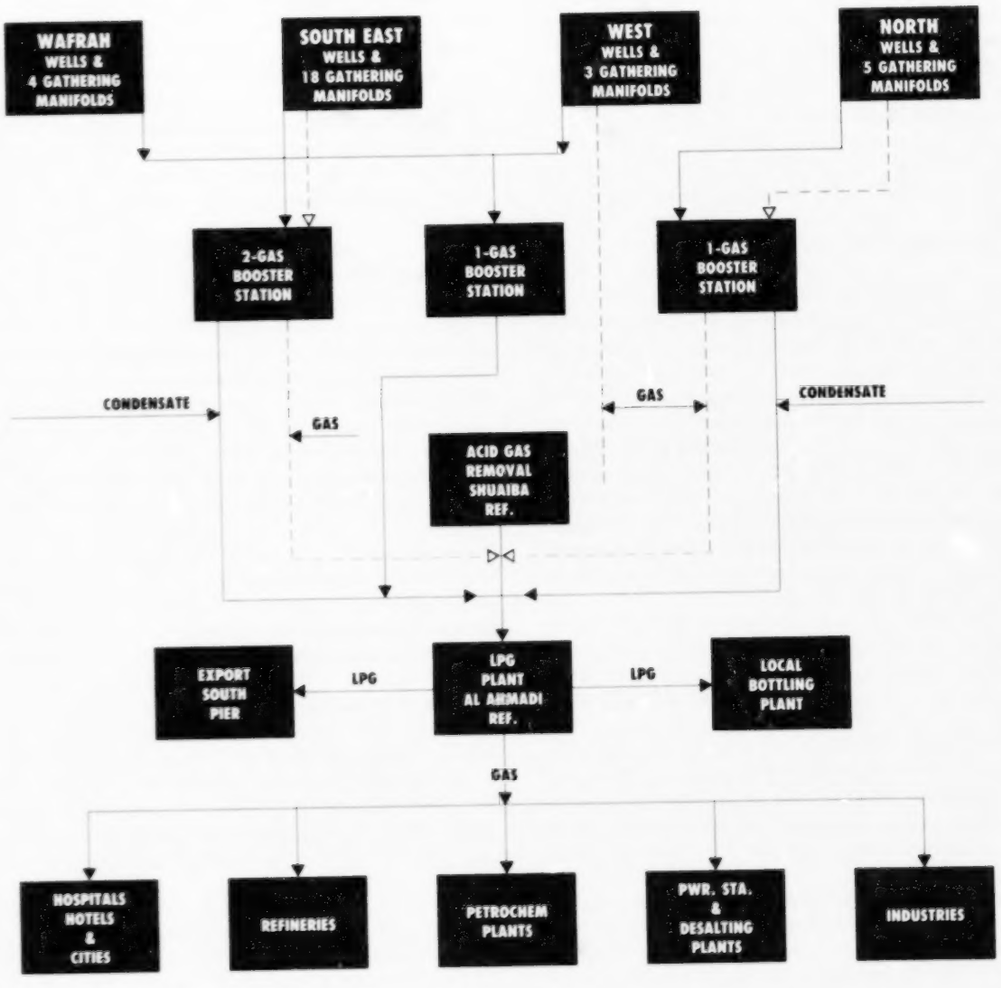
104. Closely related to the oil industry is the production of natural gas and liquefied petroleum gas (LPG). Natural gas reserves at the end of the 1980s were estimated at 1.32 trillion cubic metres but were mainly in the form of associated gas and, therefore, dependent on oil output. This gas used to be flared until the late 1970s when an LPG plant was opened at the refinery at Al Ahmadi. The gas is separated from the oil at the gathering stations in the well areas and sent to the LPG plant after having passed through gas booster stations, also located at the well areas. The LPG plant had a capacity of 43 million cubic metres per day and supplied the local bottling plant with LPG for domestic use. The rest of the LPG was exported via the south pier at Mina Al Ahmadi. The dry gas, which remains after passing through the LPG plant, was sent to the power stations, the refineries, the petrochemical plants and other factories, such as those producing cement and bricks. By the late 1980s, Kuwait was producing almost 9 billion cubic metres of natural gas annually, of which about 72 per cent was marketed.

Assessment of damage

105. The occupation brought an end to the production of natural gas and LPG. Most of the natural gas is either burning or escaping with the gushing oil from those wells that have not been set on fire. Of the four gas booster stations, the one in west Kuwait

FIGURE 2

GAS PRODUCTION NETWORK



was destroyed, another in north Kuwait was severely damaged and, of the two in south-east Kuwait, one was partially damaged and the other appears to be in good condition.

106. The LPG plant remains intact, as is the LPG bottling plant. However, 40,000 LPG cylinders and 45,000 regulators were looted and allegedly removed to Iraq.

107. Despite the relatively minor damage inflicted on the gas sector, this industry has also been crippled. The result is that the population of Kuwait, which uses LPG bottled gas mainly for cooking, is suffering a shortage of gas. By early April the gas was being imported by dry cargo ships carrying road tankers because the only pipeline usable for importing LPG had been blown up. This same pipeline had also been used for exporting LPG; this source of revenue has now been closed.

OFFLOADING FACILITIES

Situation before 2 August 1990

108. There were a number of facilities for exporting crude oil, refined products and LPG. Four of them were at Mina al Ahmadi: a) the south pier, dating from 1949, which had eight berths varying in depth from 12 to 15 metres; b) the north pier, built in 1959, which had four berths with a depth of about 18 metres and could handle tankers with a tonnage of up to 100,000 tons; c) the artificial sea-island, built in 1968, which could handle 375,000-ton tankers and consisted of a loading platform with six docking platforms in almost 30 metres of water; and d) the single point mooring, which was controlled and connected by marine pipelines to the artificial sea-island. The north pier could be used for exporting both crude and refined products.

109. The smaller ports at Shuaiba and Abd Allah were used for the export of products. The pier at Mina Shuaiba had four berths and could receive tankers with a maximum tonnage of 100,000 tons. Mina Abd Allah had an artificial sea-island in 13 to 17 metres of water and had an offload capacity of 214,000 tons.

110. On 1 August 1990, these port facilities, besides being fully integrated with the operations of KOC and KNPC, constituted the lifeline to the rest of the world, enabling Kuwait to export at that time 1.3 million barrels per day of crude oil and refined products.

Assessment of damage

111. The inspection by the mission clearly indicated that it was impossible, because of the systematic destruction of port facilities, to offload any crude, refined products or LPG, thus completing the stranglehold on the Kuwaiti oil industry.

112. At the north pier, all onshore crude offloading facilities were destroyed although the pipelines for the refined products were not damaged. The pier itself is intact and, since 1 April 1991, has been used to import petrol into Kuwait. The south pier, on the other hand, has a gaping hole of about 100 metres and all pipelines have been completely destroyed. Possible damage at the terminals could not be ascertained as clearance by EOD teams had not yet been obtained.

113. The sea-island, intended for exporting crude, was destroyed. The single point mooring appeared undamaged from the air but it cannot be used since it was controlled by the sea-island.

114. The pier at Mina Shuaiba was damaged in three different places with one large collapsed section and severed pipelines about one kilometre from the shore. The condition of the terminals is unknown, because they had not been cleared by the EOD teams. The sea-island at Mina Abd Allah could be viewed only from the air for similar reasons. It appeared in good condition but the control room may have been damaged. Still, it is impossible to use this facility because the pipelines leading to it have been blown up at the Al Ahmadi refinery.

LOCAL MARKETING

Situation before 2 August 1990

115. Local marketing was mostly done through the 81 petrol stations in the country, which largely sold petrol, diesel, naphtha and lubricating oil. Total sales of lubricating oil, which was being produced at a plant near the Mina Shuaiba refinery, amount to about $26 million per year at $1,700 per ton. The other products had been selling at an average volume of 7 million litres per day at about $0.14 per litre, totalling about $358 million per year in revenues.

116. Natural gas was sold and distributed by means of a gas pipeline network to industries, municipalities, petrochemical plants, power stations, housing complexes, hospitals and other large consumers. LPG, which is mostly for domestic use, is sold in bottles of different sizes at various distribution points.

Assessment of damage

117. The above-ground facilities of six petrol stations were completely destroyed. The cost of each was about $175,000. The remaining 75 stations sustained damage to about 50 per cent of their above-ground facilities. The below-ground parts are free of damage, but most of the rolling stock was looted.

PETROCHEMICAL INDUSTRY

Situation before 2 August 1990

118. The petrochemical industry is closely related to the oil industry and is operated by the Petrochemical Industries Company (PIC), which is a subsidiary of KPC. PIC runs two factories: a fertilizer plant and a salt and chlorine plant.

119. The fertilizer plant at Mina Shuaiba used natural gas from the LPG plant as feed stock to produce ammonia, urea and sulphuric acid (the production of ammonium sulphate had been discontinued). It consists of two parts. The old complex, dating from 1968, had a capacity of 400 tons per day for ammonia, 1,000 tons per day for urea and 400 tons per day for sulphuric acid. The new complex consists of three ammonia plants (total capacity 2,600 tons per day) and two urea plants (total capacity 2,800 tons per day). There are three ammonia storage tanks and two urea warehouses with a total capacity of 76,000 tons and 100,000 tons respectively. Virtually all products were exported since domestic use was negligible, with ammonia and urea fetching about $105 a ton and $120 a ton respectively.

120. The salt and chlorine plant, also at Mina Shuaiba (the one at Shuwaikh had been taken out of production), dates from 1986 and was built at a cost of $105 million. Its operations require sea water and about 13,000 cubic metres of natural gas per day. It produced, besides salt and chlorine (capacity 150 and 75 tons per day respectively), caustic soda (both flakes and liquid), hydrochloric acid, sodium hypochlorite, compressed hydrogen and distilled water. Most of its products were used by Kuwait's water desalination plants.

121. Other than the PIC-operated factories, there are also a melamine plant (dating from 1980 and built at a cost of $100 million with a 15,000 tons per year capacity), which went bankrupt in 1985, and is now owned by the Kuwait Industrial Bank, and a plant owned by the Kuwait Chemical Manufacturing Company, which produced resins and unsaturated polyester. The latter plant was built in 1982 at a cost of $28 million. It has a capacity of 11,500 tons per year of alkyd resin, 3,500 tons per year of polyvinyl resin and 1,500 metric tons per year of unsaturated polyester. All these products, which fetch $4,200, $3,100 and $2,800 per ton, respectively, are mostly for export. At the middle of 1990, this plant was operating at 80 per cent of capacity, with annual revenues of about $50 million and employing some 130 people.

122. On 1 August 1990, Kuwait had a modern, dynamic petrochemical industry closely intertwined with the oil industry, supplying products to the desalination plants vital for the country's fresh water supply, earning a substantial amount of foreign exchange and employing some 2,000 people. In addition, plans were being finalized to build a new petrochemical complex, using LPG as its feedstock, thus creating a manufacturing facility for more advanced products such as raw materials for plastics.

Assessment of damage

123. At the time of the mission's visit, Kuwait's petrochemical industry was completely idle. Without natural gas, the fertilizer plant could not operate, although this was not the only reason for its inactivity. Many vital components of the plant had been removed and allegedly transported to Iraq and the remaining parts had been damaged.

124. It was noted that, at the time of the Iraqi occupation, the fertilizer plant had been kept in operation for about six weeks in order to convert an existing stock of ammonia into 35,000 tons of urea. This quantity, together with an additional 45,000 tons that had been stored in the warehouse, was said to have been removed to Iraq. A further 25,000 tons of urea that had been left in the warehouse had become unusable. The total value of the urea taken to Iraq and the amount that had become unusable amounted to $12.6 million.

125. Furthermore, the ammonia recovery unit (which had cost $1.8 million) and a new (1990) hydrogen recovery unit (valued at $2.3 million), both essential components of the new fertilizer plant complex, were uprooted from their foundations and reportedly transported to Iraq. This action effectively reduced the capacity of the plant by 86 per cent for ammonia and 74 per cent for urea. In addition, two trimmers at the end of conveyor belts were removed from the urea warehouses, thereby making it impossible to offload urea in bulk form at the Shuaiba dry goods harbour. Finally, some damage was caused to the ammonia storage tanks by shell and bullet fire.

126. The warehouse (built in 1986 at a cost of $1.8 million) for storage of chlorine cylinders, located about 20 kilometres south of the salt and chlorine plant on the road to Wafrah, was completely destroyed. Before its destruction, however, it appears that 240 chlorine-filled cylinders, valued at $3,000 each, were taken to Iraq.

127. The melamine plant was thoroughly stripped of all its major units. This loss is estimated at 75 to 85 per cent of its original value. The resin and unsaturated polyester plant was completely destroyed and only a shell of the facilities remains, along with a few ransacked buildings. Of the original investment of $28 million, nothing remains. All raw materials and products were looted; the loss is estimated at $7.8 million.

SUPPORT FACILITIES AND INVENTORIES

Situation before 2 August 1990

128. Kuwait imported virtually all of its capital equipment for the oil, gas and petrochemical industries. The equipment possessed a high degree of sophistication. Because of generous resource availability, the country had followed a policy of stocking large quantities of spare parts and of built-in redundancy in case supply lines were disrupted. There was also an impressive array of rolling stock, harbour equipment and vessels.

129. The offices of KOC, KNPC and PIC were housed in modern, concrete or brick structures and were well-appointed with top quality furniture and an ample supply of desk-top computers, photocopiers, facsimile transmission machines and other modern office equipment, which provided state-of-the-art design instruments.

Assessment of damage

130. Only the wreckage of these support facilities remained at the time of the mission's survey. Over 720 offices in 25 buildings that the mission briefly inspected had been vandalized, looted and in some cases utterly destroyed. File cabinets and desks had been forced open and their contents strewn about and destroyed. Almost all office equipment, even electrical outlets, had been taken. Offices had been stripped of furniture and carpets.

131. Besides the ransacked and looted offices, warehouses, workshops, toolrooms, laboratories, open air yards and other structures appear to have been systematically pillaged. The mission was informed that, from mid-August 1990 to mid-January 1991, the occupation authorities filled trucks with equipment, machinery, spare parts, inventory and, in short, anything valuable. In order to give such actions a legal cover, store issue vouchers were sometimes filled out by the Iraqi civilian authorities describing the items taken. Much looting was also reportedly done by the military.

132. It is impossible to give a full account of all the items that were removed to Iraq and the following listing is only meant as an illustration of a much longer inventory of the equipment lost. Thus, for example, it was reported that KOC lost four 5,000-horsepower tugboats, four out of eight pilotboats (the other four were damaged), one out of two barges, two crane barges, three mooring boats, all its oil skimming equipment and its anti-oil pollution barges. Its central radio station was stripped of its panels and was later heavily damaged by an allied air raid.

133. At Mina Shuaiba, all 20 cranes were taken, as well as the 2 ambulances and about 200 company cars. In addition, its lubricating-oil plant, with a capacity of 30,000 metric tons, lost all its inventory, cans and drums worth about $66 million. The local marketing network lost about $60 million worth of petrol, diesel, naphtha and lubricating oil, as well as some 50 cars and pick-up trucks.

134. Mina Abd Allah lost all 10 tractors of its coke tractor-trailer vehicles, 4 fire trucks, more than 200 company cars, 19 welding machines and a number of lathes. A 5,000-square metre toolroom had been emptied of its contents. The mission could see evidence that heavy equipment and machinery had been removed from their foundations.

135. Laboratories at all facilities were stripped bare of most of their chemicals and many testing instruments are missing. In general, the looting and vandalizing of warehouses, storage rooms and offices formed a pattern that was present at all the facilities of the oil, gas and petrochemical industries. It was carried out in a systematic and organized fashion: from almost the beginning of the occupation until mid-January 1991, inventories were stripped bare and loaded onto trucks for transport to Iraq.

4

THE DELIBERATE TORCHING OF THE OILFIELDS REPRESENTS KUWAIT'S MOST PRESSING ENVIRONMENTAL PROBLEM OF TODAY, BESIDE WHICH ALL ELSE PALES INTO INSIGNIFICANCE. THERE HAS NEVER BEEN ANYTHING LIKE IT IN HISTORY BEFORE. THE BURNING OF THE OILFIELDS AND THE ENVIRONMENTAL EFFECTS OF THE BURNING ARE A DIRECT CONSEQUENCE OF IRAQ'S OCCUPATION OF KUWAIT.

4 ENVIRONMENT

OIL WELLS

Burning

136. The first reports of oil facilities ablaze in Kuwait came in late January as fire was set to oil installations in the Wafrah oilfield. Subsequent news reports suggested that just prior to the ground war, about 150 wells were ignited. This was followed by reports that between 500 and 600 wells had been set afire.

137. The deliberate torching of the oilfields represents Kuwait's most pressing environmental problem of today, beside which all else pales into insignificance. There has never been anything like it in history before. The burning of the oilfields and the environmental effects of the burning are a direct consequence of Iraq's occupation of Kuwait.

138. KOC officials have reportedly concluded that Iraqi soldiers set explosives around the mouth of every oil well in the country immediately after the invasion but did not prime or detonate the charges until two or three days before the Allied ground offensive began on 24 February 1991. The exact number of oil wells burning is still not known officially but the mission estimates that it may have been about 700 at its maximum. Some have started to cone and go out and others are now being put out by fire fighters. The coning of a burning oil well occurs when oil is burned off faster than replacement oil can move in from surrounding oil strata. This allows the less viscous water in the strata below to move into the rock below the well intake and to be drawn up the pipe. The water-oil mixture does not burn properly so the flame goes out. A coned well cannot be restarted and the well has to be redrilled to below the point of water intake. This phenomenon means that the oil discharge pattern is changing as the number of oil wells on fire gradually decreases, while the number of wells gushing unburnt oil increases. This in turn results in the release of more oil onto the land.

139. Estimates of the amount of oil burned each day vary but are commonly thought to be between 2 million and 6 million barrels per day.

140. Each oilfield in Kuwait is producing its own emission cloud, mainly of particulates (including soot) and combustion gases. For practical purposes, there are three basic smoke plumes—southern, central and northern—of which the central is the largest and most dense, being produced by the Ahmadi, Maqwa and Greater Burgan fields. Although adjacent to others, each well fire seems to have its own individuality—a feature recognized by oil-well firemen—reflecting different conditions at the oil entry point and making smoke and gas emission variable.

141. By the end of March 1991, there was little factual information as to the nature and composition of the emissions into the atmosphere from the burning oil wells.

Gaseous and particulate emissions

142. Electricity was restored to parts of Kuwait City on 26 March 1991, which enabled one of the three fixed atmospheric sampling stations run by the Kuwait Environment Protection Department and that survived the occupation to begin operations again. Once calibration tests are completed, this station will be able to make authoritative statements on gaseous air quality in Kuwait City.

143. Few atmospheric composition measurements of any sort have been made in Kuwait since the occupation. A United States Environment Protection Agency team measured hydrogen sulphide and sulphur dioxide levels during the week of 11 March at Rawdatayn, Maqwa, Al Ahmadi and Greater Burgan oilfields. All gave low levels of both gases. If sulphur dioxide levels continue to be low, acid rain is unlikely to become a problem. Initial measurements of total hydrocarbons in the air suggest that levels of these substances are high. As yet, it is not possible to give information on individual hydrocarbon species. There are also no analyses yet of emitted particulate composition, especially in relation to heavy metals such as nickel and vanadium, which are present in Kuwait crude oil.

144. Medical opinion in Kuwait does not think that, at the moment, there is a serious environmental problem from the well emissions. In view of the little real information available, however, caution is advised until there has been an airborne investigation of the smoke plumes and a regular, ground-based air-monitoring programme has been re-established.

145. As stated in paragraph 140 above, there are three basic smoke plumes. Each of the main plumes is relatively narrow. On 24 March, affected by southerly winds, the plume from the Maqwa field was approximately 5 kilometres wide where it crossed the

coast, while the very dense black cloud from the Al Ahmadi and Greater Burgan fields was about 15 kilometres wide in total, with an inner, very black, core about 5 kilometres wide. This black core completely obscured the sun, making it look like midnight at mid-morning. Over the oilfields, the emission plume can, depending on the winds, be almost on the ground. More normally, the lower plume boundary is, over Kuwait, some 70 to 150 metres above the ground. The plumes gradually rise as distance from the emission source increases. In general, from unmeasured observations, plumes over the central Gulf area seem to have a lower level at about 1,300 metres and an upper level at about 2,500 metres. Smoke layers from the Kuwait fires have been observed in Bahrain and over the Islamic Republic of Iran, depending on wind direction. Eventually, the smoke plume will be dispersed by weather, with the particulates falling or being washed out by rain. Detailed profiling by a specially instrumented research aircraft is necessary to establish the shape of the plumes and their constituents.

146. Ground observations suggest that the visible elements of the emission have not gone into the upper atmosphere. This may be because the oil fires were insufficiently close to create firestorm effects, which could have carried particles into the upper atmosphere. On 24 March 1991, eight fires in the Greater Burgan field were seen to swing towards each other in what could have been the start of a firestorm, but this effect lasted only a very short time. The apparent relatively large sizes of the particles may also be a limiting factor with regard to the height to which they are carried. Global climate change effects of the magnitude envisaged by some scientists are, therefore, probably unlikely.

147. Climatic effects will most likely be confined to the region, and more locally in Kuwait, where the sun-shield effects of the smoke clouds are more pronounced. When the plumes are at their most dense, sunlight does not penetrate and so is unable to heat the land in the normal fashion. Sandy desert areas do not retain heat for very long so that a few days of heavy smoke cover leads to appreciable local cooling beneath the cloud—perhaps 10° C or more. This is a temporary phenomenon, and when the plume swings away, the land heats again and air temperatures eventually rise. Kuwait authorities suggest that local air temperature lowering may have delayed the onset of spring flowering by as much as four weeks in many areas. There is, however, no quantified evidence for this and such a seasonal delay could still be within the range of natural variability.

148. Particulates from fires have been deposited on both land and sea over wide areas. In the Persian Gulf, as surveyed by the mission, they form a surface skin, which wind and currents shape into whorls and kilometre-long strands that resemble oil-slicks. The effects and consequences of these carbon deposits on the sea are not known. On land, the particles cover the ground surface and plants. In the proximity of well fields, this is mixed with unburnt oil given off as a fine spray.

149. Nothing is so far known about the composition of these particles. Samples have been collected but the analyses are not yet complete. It is not possible, therefore, to comment on the likely health and environmental consequences of these deposits.

150. The long-term consequences of this surface deposition are not known, including its effects on groundwater quality and on the soil seedbank. It is possible that it may help to improve the water retention capabilities of the soil.

Crude oil on land

151. A number of burning wells have begun to extinguish themselves naturally through the coning process (see para. 138 above). At the present time, it is believed that some 30 to 40 wells in the central and northern fields may already have extinguished themselves. The mission visited three such wells in the Maqwa field. For some time after their extinction, these wells continue to gush crude oil, pouring huge amounts on to the land. This outpouring of crude oil increased dramatically in the last two weeks of March 1991. As a result, there are now large lakes of crude oil.

152. Deep, 70-metre-wide torrents of oil have blocked roads. Oil rivers flow everywhere from the wells to newly formed oil lakes. The mission observed oil erosion of land where oil rivers scour erosion gulleys in the soil—a phenomenon that may be unique in environmental observation. Natural drainage of the land is towards the coast so that steps are being taken to stop vast amounts of surface oil flowing into the Persian Gulf. Engineers are, therefore, constructing earth-containment dams across valleys to make new oil lakes and to protect roads from oil flooding. Attempts have been made, with limited success, to reignite extinguished wells in order to reduce the oil flood. The potential input into the Persian Gulf from this flood was estimated at 60,000 barrels per day from the central fields and 20,000 barrels per day from the northern fields. Although once a danger, this is no longer considered a real threat since the earth-dam containment policy is working and the gushing wells are starting to be capped, thus reducing the oil flood.

153. The oil on the land will have to be taken off most areas by pumping, scooping or other means and retained in special oil-holding areas until suitable disposal can be arranged. Rehabilitation treatment of the remaining oil-soaked areas is still uncertain. Proposals under consideration include plowing or harrowing to mix the oil layer with sub-surface soil and sand. It is not known how successful such measures may be and the future of these oil-soaked lands will be one of Kuwait's more obvious environmental problems arising from the occupation.

154. Another major problem that must be faced urgently is the measurement of sulphur dioxide, hydrogen sulphide, carbon monoxide, nitrogen oxides, ozone, carbon dioxide, specific volatile compounds such as benzene, phenols, toluene and formaldehyde, as well as particulates from gaseous and particulate emissions. Also specific health-effect studies will be needed since the range of pollutants in the atmosphere of Kuwait could cause serious respiratory illnesses or have long-term carcinogenic and mutagenic effects.

OIL AND THE MARINE ENVIRONMENT

Conditions in the Persian Gulf

155. In late January 1991, a massive amount of oil was reported in the Persian Gulf off the coast of Kuwait. The exact origins of this release and its volume are still matters of some controversy. A special UNEP mission to Saudi Arabia overflew the slick on 7 February and estimated its volume at 1 million barrels or less. It concluded that the oil-slick along the Saudi Arabian coast was most likely the main oil-slick from the January release, although it did not rule out the possibility of other slicks being in northern Persian Gulf waters. It was not able, for security reasons, to overfly this part of the Persian Gulf to make a determination.

156. The present mission had, therefore, as a major objective to determine whether any major oil-slicks were present in adjacent areas of the Persian Gulf. It found no indication of a major oil-slick anywhere along the Kuwaiti coast and offshore as far as about 30 kilometres seaward. However, several patches of thin oil sheen of limited size were observed at different localities closer to the coast, within a range of 2 to 3 kilometres. In one place only, a small slick of heavy-looking oil was observed within 1 kilometre of the coast, extending between Al Fuhayhil and Ra's al Mangal, i.e., for about 3 kilometres along the coast. The only relatively large amount of heavy black oil was found contained in the commercial harbour of the Kuwait Fisheries Company at Mina Shuaiba.

157. During the mission's aerial surveys of the coast (20 and 22 March 1991), narrow bands of black carbon particles extending over varying distances were observed, obviously resulting from atmospheric deposits of carbon emitted with the soot from the burning oil wells.

158. There was no indication of any massive fouling of beaches. Only in a few scattered sites along the Kuwait coast visited by the mission were oil traces and deposits found. For example, accumulated black oil was observed on the beach inside coastal embayments where oil is likely to be trapped (in Al Fuhayhil, e.g.). In the southern part of the coast, near Umm-Qusubah, oil was found on the beach under 10 centimetres of sand. Also during the mission's aerial survey on 20 March 1991, some black oil was noted onshore in two small stretches of the shoreline close to the amenity facilities in the Al Khiran area.

159. KOC officials, in their briefing to the mission at KOC headquarters at Al Ahmadi, stated that the occupation authorities had begun to build up the storage quantities for release into the Gulf. According to the KOC log books, there were 10.7 million barrels in storage at 22 January 1991. Shortly after that date, the Iraqis reportedly released the oil from the tank farms to the sea through the pipelines leading to the KOC sea-island. A few days later, an Allied pre-coup bombing air raid destroyed the two loading manifolds downstream from the tank farms as well as the KOC sea-island, thereby effectively halting the flow of crude oil into the Persian Gulf. There were only 1.5 million barrels left in the tank farms. It is estimated that at least 6 million barrels of oil were released. The balance (3.2 million barrels) may have been partly removed to fill in the defensive trenches along the Kuwait-Iraq border and the rest probably burnt.

160. The above statement by the KOC officials accounts for 6 million barrels of crude oil released into the sea. They further confirmed that there were three Iraqi oil tankers anchoring off the north pier, each of 200,000 tons of crude oil capacity, with a total maximum of 600,000 tons, or 4.2 million barrels. These ships were said to have deliberately unloaded crude oil into the Persian Gulf, as the ships were seen rising gradually as they released their oil contents. One of these ships was damaged by the same air raid described above, which stopped its release of oil.

161. A satellite image taken on 25 January 1991 shows a long plume of smoke originating from two close-by sources about 16 kilometres off shore: the bombed sea-island and the tanker. This means that the spillage occurred sometime during the period from 22 to 25 January, sufficiently long to achieve the 6 million barrel quantity dumped. By means of scaling from the same image, it is possible to determine that the oil-slick was about 50 kilometres long and 8 kilometres wide on 25 January. Assuming that the slick had an average thickness of 0.5 centimetres, the resulting volume could be as large as 2 billion litres (13 million barrels) or more than sufficient to contain the 6 million barrels released from the tank farms and the 4.2 million barrels from the tankers.

162. In the light of the above, it seems reasonable to assume that such an oil-slick was formed on or about 24 January 1991. However, it is evident that a large portion (about 50 per cent) of the slick has quickly evaporated. The remainder, under weathering effects and degradation, has diminished and broken into small patches which moved southwards and reached the Saudi Arabian waters in a much lesser amount of approximately 1 million barrels. This was clearly observed and confirmed by a UNEP expert mission to Saudi Arabia.

Effects on the marine environment and related activities

163. The "sheen" effects on the sea surface appear when the oil surface film is less than 1.5×10^{-4} millimetres in thickness. At this thickness, the oil film probably reflects more light than it absorbs but no work appears to have been done to examine the light effects of oil pollution upon phytoplankton primary production.

164. Perhaps of greater concern are macrophytes such as seagrasses. These will be affected both by toxic hydrocarbons and contamination of sediments. Oils penetrate stomata and can lead to death of the plants. Seagrass beds provide the nursery grounds for commercially important shrimps. So, even if the seagrass beds are not subject to direct oil pollution because of their depth, the young shrimp may be affected by the toxic residues of partially degraded oil. Shrimp, which breed in spring, live for little more

than a year, so contamination of the seagrass beds now could severely reduce shrimp catches for a whole year and lead to significant reductions in the following year. Apart from their importance to shrimps, the extensive seagrass beds provide food and a habitat for a wide variety of marine organisms and are a major contributor to the productivity of the Persian Gulf.

165. Another fragile ecosystem existing in the Kuwaiti marine environment is the coral reef communities that occur at the three coral islands—Kubbar, Qaru and Umm Al Maradim. The parts of these reefs that are very close to the surface will be at risk from direct oil impact, especially if oil coats the corals during extreme low tides. The polyps of which the reefs are formed are also highly sensitive and easily killed, either by direct smothering with oil or ingestion of oil droplets in the water column or toxic oil derivatives. Recovery will be slow because corals are already at the limit of their distribution in the high salinities and temperatures of the Persian Gulf waters.

166. Furthermore, in the coastal waters of Kuwait, particularly in the north and around Bubiyan Island, there is a very broad intertidal zone, with extensive mudflats coated with blue-green algae which provide the basic input for the food chains of many fish and crustaceans. These mudflats also provide the feeding grounds for numerous species of wading birds. The beaching of oil on such mudflats will not only smother the surface algae, but will also kill the fauna of worms and crustaceans upon which both fish and birds feed.

LAND DEGRADATION

General considerations

167. In its overflights and ground surveys, the mission found that large parts of rural Kuwait showed land degradation dating to before the occupation. Overgrazing effects were widespread. Other areas known to be favoured for seasonal camping showed vegetation reduction, while vegetation composition suggested that woody shrubs were less prevalent in these areas than might be expected. Environmental factors resulting from the war enhanced impacts on these areas because they have been subjected to stress from prior forms of land usage.

168. Land degradation is taken here to mean all forms of land disturbance that have altered the basic surface soil structure and its overlying vegetation cover. All data on land degradation were gathered by the mission during overflights and ground field trips. The mission also held discussions with Kuwaiti Environment Protection Department staff.

Military fortifications

169. The Iraqi military fortified many areas of Kuwait prior to the Allied ground offensive. These fortifications were particularly well developed along the southern border of Kuwait and along the entire coastline but especially in the central part where seaborne Allied landings were expected. However, defensive constructions abound in most parts of the country, being most abundant along roads, around military and communication centres and on most high ground.

170. Those constructions, made of stone and concrete, will persist unless they are removed. Such removal will be necessary in urban areas and in scenic and tourist regions such as at points along the coast and on the escarpment in the Jal Az Zawr National Park.

Off-the-road vehicle movement

171. The movement of large numbers of wheeled and tracked vehicles over desert lands can break up the upper sand and soil horizons leading to subsequent wind and water erosion. Repeated damage by vehicles can cause mortality of perennial desert herbs and tussock grasses such as *Panicum turgidum*. Tanks and other tracked vehicles are generally thought to be more destructive in these respects than vehicles with wheels.

172. During the ground war, several thousand Iraqi and Allied vehicles were driving across the desert plains of Kuwait. Several engagements were fought, involving manoeuvring of heavy tracked vehicles, often at speed. The potential for soil and plant damage was, therefore, considerable.

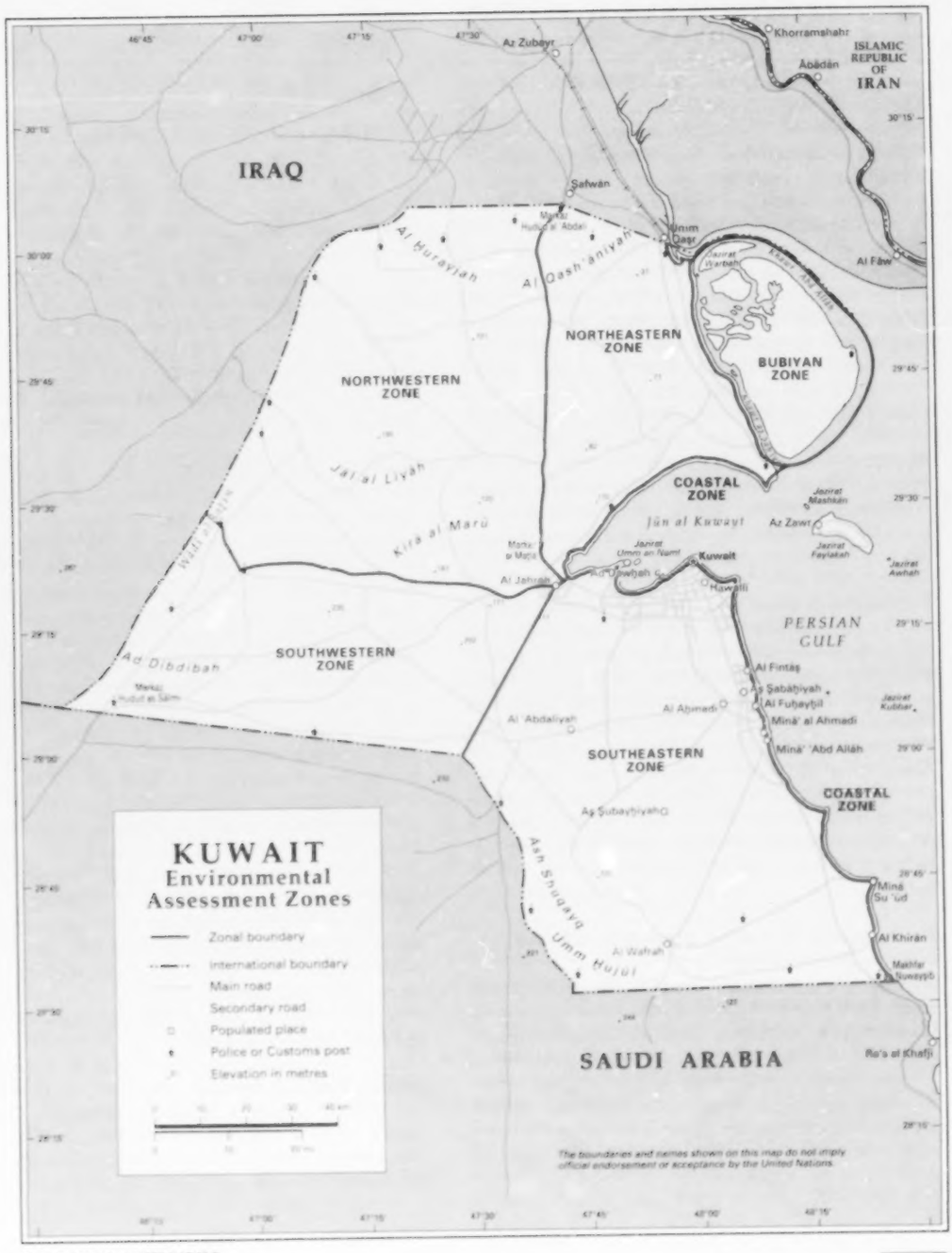
173. Aerial surveys by the mission showed that in many areas, particularly in western Kuwait, there were sets of old tracks made by wheeled vehicles, as well as newer tracks from the recent war. The old tracks were presumably from pre-war camping, hunting or oil survey parties. They stood out as twin bands of very green, often shrubby, vegetation resulting from the current widespread rains. The early wheel tracks functioned here like the hollows described above, with resultant increased plant growth in the wheel ruts. In some areas, the newer wheel and tracked vehicle traces will heal through vegetation growth. In other areas, however, the tracks will erode owing to wind action blowing sand and soil particles into the air. Kuwait is known for its seasonal dust storms and dust fallout onto Kuwait is perhaps the highest in the world. The number of dust storms and their severity may well increase as a result of the abundance of loose sand and soil particles within newly formed wheel tracks. Some of these additional wind-blown particles may be deposited on coastal marine ecosystems. These problems will persist until the re-establishment of a soil-stabilizing vegetative cover.

Geographical distribution

Coastal zone

174. This zone (see map 3) consists of the beach together with a strip of land fronting the shore. The width of this strip varies according to locality, reaching in places up to some 300 metres from the shoreline.

MAP 3



MAP NO. 3631.11 UNITED NATIONS
APRIL 1991

175. The Iraqi occupation forces constructed very heavy defence lines along the entire length of the sea coast. Bubiyan Island has substantial defences around its south and east coasts but not its west and north, which face Iraq. Faylakah Island is entirely ringed by coastal defences. As far as could be determined, none of the other islands overflown had sea defences (Umm Al Maradim, Kubbar, Quhat and Mashkan). The normal pattern of coastal defences involves one or more outer lines of barbed wire in the sea as fences or coils, a mixture of stakes in the sand and concrete blocks, followed by more barbed wire on land. These are backed by machine-gun positions, gun emplacements and armoured vehicle revetments. Obstacles impeding vision and field of fire have been removed and buildings converted to firing positions. Shoreline defences are intermingled with minefields. These defences are most complex in the southern part of the country and along the coastline of the whole urban complex. On the very southern coastline there are some vehicle disturbances and some craters. From Al Jahrah northwards the coastal defence works became less complex, being reduced to lines of barbed wire with, in places, trenches behind. These defences are in association with minefields. Vehicle track disturbances and crater formation are not extensive. The environmental disturbance from Al Jahrah to the Saudi Arabian border can in general be classed as severe to very severe. There are a few patches, however, where disturbance is only light to moderate. From Al Jahrah northwards disturbance is mainly moderate but light in some places.

South-east zone (south of the Manaqish-Al Jahrah line)

176. Gun emplacements, armoured vehicle revetments, trenches and the like are commonplace everywhere, particularly on raised areas and at points commanding roads, communication centres and other strategic locations. Disturbance is moderate to severe in areas where constructions occur. Crater damage and vehicle track disturbances are severe to very severe in areas near the Saudi Arabian border and in zones bordering the main road to Kuwait City. The international border in the south is marked by fences and two parallel 4-6-metre-high sand berms separated by a wide, deep ditch that was intended to be filled with oil. Elsewhere vehicle track damage is slight to light and there are relatively few craters.

North-east zone (east of the Al Jahrah–al-Abdali line, excluding Bubiyan Island)

177. Constructions are found along all roads, on all elevated positions and around all oilfields, military camps and harbours. Constructions are extensive on top of, and behind, the Az Zawr ridge. On open sandy areas, particularly near the periphery of the zone, there is tracked vehicle damage. Craters occur near all military positions. In strategic areas, disturbance is severe, but elsewhere it is moderate. Trenches and vehicle revetments can be found in the remotest of areas, although they are not normally extensive.

Bubiyan Island

178. There is some defensive construction but only moderate vehicle track and crater disturbance in some places. In general, Bubiyan Island seems not to have been greatly disturbed.

North-west zone

179. There are scattered constructions throughout, becoming very prevalent in the north close to the Iraqi border. Ammunition dumps, fuel-bowser centres, vehicle revetments, trenches and bunkers of many types abound. Vehicle track damage in the north is severe in places. There are very disturbed areas where large numbers of heavy tracked vehicles manoeuvred, churning the soil in the process. Elsewhere such vehicles advanced cross-country in line-abreast formations, creating extensive parallel tracks. Where military constructions occur, craters abound. In the northern part of the zone, the disturbance in places is severe to very severe; elsewhere, it is moderate. In the southern zone, disturbance seemed mainly light, except along main roads. Some mainly east-west–oriented oil trenches were found in a number of places.

South-west zone

180. Scattered constructions occur on high ground and along the extensive minefield that crosses the southern part of the zone from east to west. The southern border of Kuwait has parallel lines of sand berms and trenches to contain soil. There are few cratered areas. Where pathways were cleared through the border defences and the minefields, there is severe local disturbance of the soil where vehicles funnelled into and out of crossing points cleared of mines. Over most of the zone vehicle tracks are sparse or absent, making this zone, over all, the least affected of all the zones.

Other land degradation types

181. In the time available to the mission, it was not possible to examine all forms of land degradation. Based on documented experience in other war zones, the following are land degradation activities that are likely to have occurred: cutting of shrubs and trees for firewood and camouflage; damage to anti-desertification greenbelt plantations; and the burning of vegetation, both deliberately and inadvertently through ordnance explosions, burning vehicles and ignited fuel. Other likely adverse environmental activities include the shooting or killing of wildlife for sport or food and the contamination of soil and groundwater through seepage of fuel and oils, toxic camouflage paints and other similar substances.

National parks and reserves

182. Before August 1990, Kuwait was in the final stages of preparing a detailed protected areas system. Three sites had been officially established from a series of nature conservation areas which were proposed in its market action plans, the most

well-known of which is the Jal Az Zawr National Park near Kuwait City.

183. The Wadi Al Batin Desert Park is crossed by the main east-west minefield and its associated structures. Scattered earthworks and other constructions occur in some areas, especially on high ground, but most of the park seems to remain unaffected by the war.

184. The Umm-Nigga Desert Park is difficult to locate on the ground from the air. It is crossed by tracks, roads and pipelines (some damaged). Structures of various types are along roads and on high ground or near strategic points. Trenches and bunkers have been built along parts of the shore of the Khawr as Subiyah.

185. The Jal Az Zawr National Park, the ridge crest and areas to the north of it contain extensive substantial military constructions. Those on the ridge area are obtrusive and should be removed. The foreshore has defensive constructions but these are not extensive. The trenches and other earthworks will gradually disappear. The barbed wire, particularly that in the water, should be removed. On the whole, the foreshore and adjacent marshes are in good condition.

MINES AND OTHER UNEXPLODED ORDNANCE

Background

186. During its seven-month occupation of Kuwait, the Iraqi military took steps to fortify the country against invasion by the opposing Allied forces. An important part of their fortification was the laying of minefields, on land and in the sea, across likely invasion routes and around installations and positions considered to be of strategic significance.

187. The Allied aerial bombardment of Iraqi forces in occupied Kuwait lasted from 17 January 1991 until their final withdrawal from Kuwait on 27 February 1991. Both this aerial bombardment and the accompanying military movement into Kuwait, and subsequent engagement of Iraqi forces, by Allied ground units (24-27 February 1991) involved very considerable use of explosive ordnance by both sides. For a variety of reasons a proportion of this ordnance did not explode and a large part was abandoned by Iraqi forces.

188. Mines and other unexploded ordnance together constitute a major and perhaps long-lasting threat to the environment of Kuwait and to the security and well-being of its people.

189. Both anti-tank and anti-personnel mines were used. The standard anti-tank mine is the VS 2.1 kilograms. Anti-personnel mines include the VS 50, SB 33 and the Valmara 69 jumping mine. The mines are constructed almost entirely of plastic with only the firing pin of metal. They are, therefore, very difficult to locate with most mine-detecting equipment. International agreement calls for the mine-laying party to insert metal pellets in special pockets in the explosive mass as an aid in mine detection at the end of hostilities. The metal pellets were not inserted by the Iraqi forces.

Location of minefields

190. All information on geographical distribution of the minefields (see map 4) is based on *Kuwait Danger Areas* maps, 19 March 1991 edition.

Coastal zone

191. With minor exceptions, the whole Persian Gulf coast of Kuwait from Iraq to Saudi Arabia was sown with a combination of anti-tank and anti-personnel mines. The minefields form part of an overall coastal defence system involving submerged offshore marine mines and an onshore arrangement of barbed wire, stakes, blocks, trenches and gun and tank emplacements. The mines have been laid both above high tide levels and in the inter-tidal zone. To avoid them floating, mines placed in the inter-tidal zone are sometimes individually tied to a mesh net that is itself pegged to the ground surface. In most cases, the mines are covered by sand or only slightly protrude from the surface. Operations at the Shuwaikh port, which has a very narrow access, were rendered particularly dangerous because of the proliferation of sea mines.

Southern zone

192. The most extensive minefields in Kuwait are in the south of the country behind its border with Saudi Arabia. Between Al Khiran on the coast and the Manaqish oilfields in the west, the minefields are in solid, roughly parallel lines three or four minefields deep. From the Manaqish oilfields to the Hudud As Salmi custom post in the extreme west of Kuwait, and beyond into Iraq, there is a single continuous set of minefields with outlier fields in front and behind. Very large numbers of mines were used in these fields. On those crossed by the Wafrah road where the mines were visible, the mission estimated the density as 2 to 6 mines per square metre depending on mine type. In Kuwait a mixture of anti-personnel and anti-tank mines was used. In those Wafrah fields examined, most of the mines seen were anti-personnel and linked by trip-wires.

Central zone

193. Extensive minefields (anti-personnel and anti-tank) were set along the north coast of Kuwait Bay and in a southwest-northeast line just to the north-west of Al Jahrah. This defensive line is backed by secondary lines just behind the Az Zawr heights and by areas near a few centres of strategic interest, such as the air bases, army barracks and communication centres.

Other areas

194. Minefields occur at sites of strategic concern in and around Kuwait City and at a few isolated locations in the south and central areas. Faylakah Island has three known minefields in its

MAP 4

MAP NO. 3631.13 UNITED NATIONS
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central area away from the coast—two in the west of the island and one in the east—all containing predominantly anti-personnel mines. Apart from the minefield that crosses the western border of Kuwait in the extreme south-west, there are no other known minefields in the west and north of Kuwait along its borders with Iraq.

Unexploded ordnance

195. Unexploded devices can be found anywhere in Kuwait, particularly where battles took place or targets were attacked. *Kuwait Danger Areas* maps show the locations of some abandoned tanks or military equipment, but not all. Buildings in Kuwait City and other urban areas still contain many explosive devices. By 28 March 1991, 3 million such devices, including mines, had been cleared from Kuwait City and adjacent areas. No information was obtained by the mission on unexploded bombs and missiles.

196. Commonly encountered devices include cluster bombs/bomblets and unused ammunition ranging from small arms to rocket-propelled grenades and large artillery mortar shells. These are normally found in ammunition dumps or with abandoned guns, tanks and other military equipment. Booby traps were still being encountered at the time of the mission.

Unexploded ordnance disposal

197. The military of six nations (United States of America, United Kingdom of Great Britain and Northern Ireland, France, Canada, Saudi Arabia and Kuwait) were coordinating their search, detection and removal operation through the EOD group from their headquarters with the Combined Civil Affairs Task Force (Camp Freedom). By 19 March 1991, a few areas had been cleared, including the runways and aprons of Kuwait International Airport, Shuaiba harbour and a few lengths of beach and seafront in Kuwait City (*Kuwait Danger Areas* maps, 19 March edition).

198. The military have experienced casualties in these clearance operations. In the future, it is expected that most clearance operations will be done by specialist civilian companies under contract to the Government of Kuwait. The question of insurance liability for those injured by explosive devices in areas said to have been cleared remains to be solved.

199. Mines and other explosive devices pose a hazard to the civilian population that will persist for some time to come. Kuwait currently has a much smaller population than its pre-war level. Even with this low population, injuries from ordnance explosions are occurring at the rate of 4 or 5 per day, usually involving severe injuries to arms and legs according to reports from emergency rooms at hospitals. Souvenir hunting among abandoned Iraqi military vehicles and among the quite large number of small ammunition depots all along the coast had by 20 March 1991 reportedly led to more than 50 deaths.

Future implications

200. All the mine and ordnance experts consulted stated that there is no guarantee that swept areas are entirely free of explosive devices. *Kuwait Danger Areas* maps mark the cleared areas in green and accompany them with the following warning legend: "Area swept—approach with caution". These same experts were unanimous that large areas of Kuwait have so many mines that it is impractical to lift them, particularly the vast minefields that cross the southern part of the country. Mine experts recommend that these areas be clearly indicated and very securely fenced. A number of passageways will have to be cleared through these minefields where they form a barrier to the seasonal movement of pastoralists and their livestock or to recreational and leisure safaris.

201. Several of the actual and proposed protected areas of Kuwait contain minefields and unexploded ordnance. These dangerous areas could be securely fenced to exclude the public and overseas visitors. The Jal Az Zawr National Park on the north of Kuwait Bay is particularly affected since minefields have been set along its coastal flats and marshes, and along parts of the top of the escarpment—both areas of prime interest to visitors. Other proposed national parks or reserves that now contain minefields include the Wadi Al Batin Desert Park (large minefields in its southern area) and the Umm Al Maradim Marine Park (mines and unexploded ordnance along much of the coast; some minefields may also be found in the land part of the reserve). The Faylakah Marine Park should be free of mines, although they may be encountered in other parts of the island.

202. The beaches of Kuwait—and to a considerable extent mined coastal waters also—pose the biggest environmental hazard from munitions because they provide one of the main recreational areas for the people. Although some parts can be fenced off, the majority will have to be swept as effectively as time and resources allow. It must be recognized, however, that there are likely to be injuries from explosions from time to time for several years to come. Because of the large concentration of mines placed it will be virtually impossible to achieve full guarantees after the cleaning.

203. A programme is required to educate the people, including the pastoralists, to the dangers of entering fenced-off minefields and of encountering unexploded devices. In addition, medical services must be prepared to cope with this new form of injury and the public must be educated as to how to respond when explosion injuries occur, and on how to summon the most immediate help.

ENVIRONMENT-RELATED INFRASTRUCTURE

204. The Environmental Protection Council of Kuwait is the body that oversees the collection and interpretation of environmental data and advises the Government on its direction and policies with regard to the environment headed by the Minister of Public Health.

205. The Environmental Protection Department has five sections (research, finance, administration, public relations and information) and a computer centre. The research programme carried out by the technical divisions includes monitoring and assessment activities in air pollution, water pollution, soil pollution, terrestrial ecology and marine science. Technical facilities operated by the Department include three fixed air pollution monitoring stations (at Mansouriya, Rabia and Reggai, which have produced monthly reports since 1984. In addition, the Department operated five mobile air pollution monitoring laboratories to cover general air pollution as well as some specialized pollutants such as hydrogen sulphide, particulates and noise. There were also some 10 dust-sampling stations. Three well-equipped marine research vessels were operated, together with a small but well-equipped marine laboratory at Al Bidaa.

206. During the occupation, three mobile air pollution monitoring laboratories were removed by occupation forces. The three marine research vessels were either removed or destroyed. The marine research station at Al Bidaa, on the waterfront, had soldiers living in it who swept all the equipment outside to make room for their crew's accommodation needs. The station is now completely wrecked and the equipment ruined. The Industrial Medicine Centre in the Shuaiba Industrial Area was also completely vandalized.

207. Another centre at Shuaiba, which is run by the Shuaiba Area Authority, has been reported as completely looted and destroyed. The centre included several laboratories that were fully equipped for industrial pollution monitoring, including continuous air and water pollution monitoring by fixed stations.

208. The Department's Computer Centre, with its mainframe VAX and its supporting microcomputers, survived intact. It is not operating because of a lack of electricity; the computers have also been without maintenance for several months. The three fixed air monitoring stations also survived intact but need electricity to make them functional. Each station when operational monitors wind direction and speed, temperature, relative humidity, NO_x, methane, non-methane hydrocarbons, ozone, carbon monoxide, NO, NO_2. One station also monitors ultraviolet and infrared. One station in the industrial sector was visited. It is situated on top of a local medical clinic. The clinic had all its equipment removed. The air monitoring station was left because the Technical Adviser to the Department told the removal crews that the instruments were fixed and would break if moved and that they would be in trouble if they delivered broken equipment to Baghdad. They contented themselves by pulling out all the computer paper and stealing the three fixed air conditioning units.

209. Some staff trained to operate the stations are available locally. Most were expatriates who have left Kuwait. Several expatriates have indicated their willingness to return as soon as the situation improves and they are allowed to enter Kuwait.

210. The mission was also informed that all the stockpile of equipment and material for combating oil pollution had been removed and transferred to Basra during the early days of the occupation. The equipment, partially imported and partially produced locally, was an essential part of the Kuwaiti national contingency plan for cases of oil pollution emergency. The equipment included 14 oil skimmers, 10,138 metres of booms of different types, 9 oil pumps, 282 barrels of chemical dispersants of different types, 3 boats, 2 cleaning cars, training equipment, 1 generator, and several other items. This equipment had on several occasions been used for the training of regional experts during courses organized by the Regional Organization for the Protection of the Marine Environment.

211. The mission was provided with seven lists of items looted or destroyed during the occupation, covering fixed and mobile air and water quality monitoring stations, marine research stations and laboratories, office supplies, research vessels, transport and communication facilities, and the oil pollution combating equipment.

5

. . . MOST LIVESTOCK [IN THE WAFRAH AND ABDALI AREAS] HAD BEEN REMOVED OR EATEN DURING THE OCCUPATION . . . THOSE LIVESTOCK THAT DID SURVIVE THE OCCUPATION MAY NOT SURVIVE THE OIL-FIELD CONFLAGRATIONS . . . NEW-BORN CALVES WERE REPORTEDLY DEAD IN A FEW DAYS . . . ONLY ONE CAMEL WAS SEEN, IN A VERY POOR CONDITION WITH A FLACCID HUMP.

5 AGRICULTURE, LIVESTOCK AND FISHERIES

AGRICULTURE AND LIVESTOCK

Situation before 2 August 1990

212. Agriculture in Kuwait was never extensive since it is almost entirely dependent upon irrigation and thus on water availability. A 1966 soil survey carried out by the Food and Agriculture Organization of the United Nations (FAO) identified about 200,000 hectares as being relatively suitable for agriculture under irrigation but expressed caution on the long-term use of brackish water since it could lead to salt accumulation in surface layers. Wind and wind erosion also adversely affect crop growth in Kuwait so that the provision of adequate windbreaks and shelter-belts is essential.

213. The total area under cultivation in Kuwait amounts to less than 0.5 per cent of its total land surface. There are two main agricultural regions—Abdali in the north-east and Wafrah in the south. Some plantations and shelter-belt activities are in the Al Jahrah area.

214. In 1983, the total cultivatable area, taking factors additional to soils into account, was estimated at 150,000 hectares, of which 1,200 hectares were under fruit and vegetables. By 1985, this had risen to 4,500 hectares for vegetables and 2,200 hectares for fruit trees and timber. By 1987, there were 520 farms in the Abdali and Wafrah areas. This agricultural expansion was actively fostered by the Government through the provision of interest-free or low-interest loans, annual farm subsidies and financial aid in drilling wells for agricultural purposes. Government policy was to make Kuwait self-sufficient in vegetable produce. Intensive greenhouse crop production, therefore, rose dramatically during the 1980s, and in 1986, for example, 270 hectares produced 32,300 tons, while normal winter vegetable crops on all other land amounted to 74,500 tons. The main agricultural crops are cucumbers, dates, melons, onions and tomatoes. Before the occupation, Kuwait exported some vegetables to neighbouring countries. Irrigated alfalfa was also grown as fodder for livestock. There were feasibility studies to increase greatly the extent of irrigated date plantations. Little grain was grown, owing to the lack of irrigation water, although attempts were made to increase production.

215. Animal husbandry was traditionally the main activity of the rural population prior to the development of the oilfields. In recent years, the Government had done much to encourage livestock production by Kuwaiti citizens. Livestock numbers were estimated in 1988 at 26,000 cattle, 300,000 sheep, 20,000 goats and some 28 million poultry. Camels were also raised in areas adjacent to agricultural regions such as Wafrah. An additional 8,000 camels were estimated to be maintained by nomadic people. In recent years, cattle numbers, particularly Friesian dairy cattle, have risen sharply. Consequently, milk production increased from 9,000 tons in 1980 to some 50,000 tons in 1985 and was projected to reach 110,000 tons in 1992. The rise in sheep numbers from 21,000 in 1979 was a result of government encouragement of wool production and to provide Kuwait with a more certain supply of meat less dependent on the vagaries of foreign supply. As part of this livestock programme, holding areas were set aside for livestock and, by 1987, there were 287 of these for cattle, 1,325 for sheep and 598 for goats. Poultry production was also encouraged so that numbers rose during the 1980s, with egg production reaching some 477 million a year in the late 1980s.

216. Agriculture and livestock are looked after by the Agriculture Affairs and Fish Resources Authority, which in 1987 had 0.7 per cent of Kuwait's annual budget available to it. The Authority provided advice and extension services to local farmers. It also improved agriculture in Kuwait by helping farmers to expand the area under cultivation and by ensuring better seed quality. The Authority carried out research in various fields of agriculture and operated an experimental farm that included sections on poultry, dairy production and hydroponics. The Authority also administered the Kuwait Zoo.

Assessment of damage

217. Because of prevailing circumstances, the mission was unable to contact anyone from the Authority concerning agriculture in Kuwait. Nevertheless, the mission made a ground visit to Wafrah in the company of a smallholder from the area and agro-industrialists provided some information. On 22 March 1991, the mission overflew both the Wafrah and Abdali areas.

218. At the time of the visits, both areas seemed to have been abandoned. In Wafrah the Authority's office was empty. Most farms and smallholdings had suffered damage to greenhouses and to irrigation systems. Houses close to the border with Saudi Arabia had been occupied by Iraqi military to provide accommodation space. They had been vandalized. Water pumps, generators, tools and similar items had been removed. Much fencing had been wrecked. The mission visited a variety of farms, including dairy farms, poultry farms and a horse-breeding establishment. In all cases, equipment had been removed or smashed. The principal problem at present, however, is that the entire farming complex of Wafrah is heavily dependent upon irrigation water and it is clear that the irrigation system has not been working for some time. Perennial plants will need water soon if they are to survive. Many of the irrigated date palms will not last the coming summer without water. The mission overflight of the Abdali agricultural area suggested that conditions at Abdali were very similar to those at Wafrah.

219. No livestock were seen in either area on any of the mission's survey visits. Those who remained in Kuwait during the occupation sometimes took dairy cattle and other farm animals into their homes in an effort to save them. Sometimes this was successful and the mission saw two Friesian cattle being driven south in a pick-up truck. The mission was informed that most livestock had been removed or eaten during the occupation and that few remain today. Ruminants and other large herbivores are unlikely to do well in areas within the zone affected by the oil fire smoke plumes. Thus, those livestock that did survive the occupation may not survive the oilfield conflagrations that followed. New-born calves were reportedly dead in a few days. Only one camel was seen (at the northern end of the Wafrah road), in very poor condition with a flaccid hump. But in a mission overflight on the central western border with Iraq, a number of pastoralists were seen with camels, sheep and goats in what appeared to be good condition. No estimates of remaining livestock numbers at the time of the mission's visit could be obtained. It is safe to say, however, that the numbers must be very much less for all types than before the occupation.

FISHERIES

Situation before 2 August 1990

220. While Kuwait, like other States in the region, derives most of its income from oil, the fishing industry continues to be of economic and cultural importance, and some communities still subsist on fishing.

221. Over the last five years, commercial fisheries have provided an annual yield of 5,000 to 6,000 tons. Offshore species once led in yields, but the importance of nearshore species has recently increased. Much of Kuwait's fishing industry is focused on the capture of these nearshore species. The shrimp (*Penaeus semisulcatus*) and hammor (*Epinephelus tauvina*) fisheries are particularly important. Kuwait is one of four countries in the region that have significant shrimp fisheries, with approximately 180 trawlers, most of them small, in operation.

222. The main fishing company in Kuwait is the privately owned Kuwait Fisheries Company, whose shrimp catch represents about 10 per cent of the total catch of the country. The company, with its facilities and pier located in the commercial harbour at Shuaiba, is self-contained. It owns a fleet of 20 trawlers (each 28 metres in length, with freezers and processing facilities), factory for processing and packing, workshops, communication facility, etc.

Assessment of damage

223. The mission visited the factory, which had been looted and vandalized. About a third of the plant's structure was heavily damaged and must be rebuilt. None of the trawlers was left; executives of the company claimed that they had been taken to Iraq. In fact, the company had no trawlers in its large docks.

224. Traditional fishermen were also severely affected. Their fishing boats were destroyed and most of them sunk, which the mission observed in its coastal inspection. Moreover, the terminal where their catch was sold was seriously damaged and needs major repair before it can become operational.

225. Fishing activities had ceased completely when the mission was in Kuwait. Not only had fishing boats disappeared but the sea mines continued to pose dangers. Even if these obstacles are overcome, other problems still remain. The fisheries industry will also suffer for some years from the negative consequences of the oil-slick in the Persian Gulf, which may result in the killing or smothering of fish, shrimp, plankton and other marine eggs and larvae, as well as the destruction of spawning grounds (in laboratory tests, the mortality of fish eggs in surface oil film was between 70 and 100 per cent). This is likely to disturb the life cycle of fish and shrimp in the Kuwaiti waters and hence will reduce the country's capacity for seafood production.

1 *Oilfields ablaze near Kuwait International Airport*

2 *Destruction of the south pier at the Mina al Ahmadi oil refinery*

3 *Part of the long stretches of the heavily mined coastal area fortified by barbed wire*

4 *Fishing boats and dhows destroyed by the occupation forces*

5 *South Subahiya Telecommunications Centre totally destroyed by explosives*

6 *Wreckage of the Earth satellite station in northern Kuwait*

7 *Partial destruction of the Bubiyan bridge linking the island with the mainland*

8 *One of the three pavilions of the Kuwait International Trade Fair, covering an area of 34,000 square metres, that were totally destroyed*

9 *Historic building of the old Museum of Kuwait destroyed by the occupation forces*

10 *Morning sky darkened by oil fires over Mina Abd Allah*

11 *Part of the devastated commercial district in Kuwait*

12 *A member of the mission inspects the interior of a private residence gutted by fire*

13 *Destruction at the Mina Abd Allah oil refinery*

14 *An automobile showroom completely destroyed in the Shuwaikh industrial area in Kuwait City*

15 *One of the many ransacked school libraries*

16 *Kuwait International Airport suffered considerable damage and some hangars were totally destroyed*

17 *The Regency Hotel lobby in Kuwait City. Seven de luxe and first-class hotels were either destroyed or heavily damaged during the last days of the occupation*

18 *A typically vandalized government office*

19 *A classroom destroyed by the occupation forces*

20 *A large number of apartment buildings and houses along the coastline were taken over by Iraqi forces and fortified*

21 *Lake of oil at the Al Maqwa oilfields with burning wells in the background*

22 *The building housing the Ministry of Foreign Affairs was heavily damaged and ransacked*

PHOTOS: UNITED NATIONS/JOHN ISAAC

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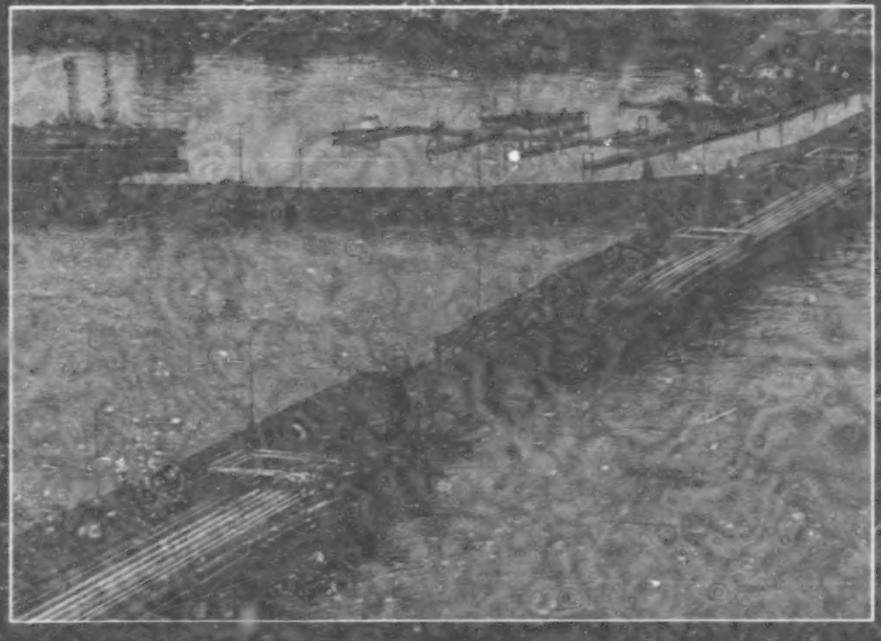

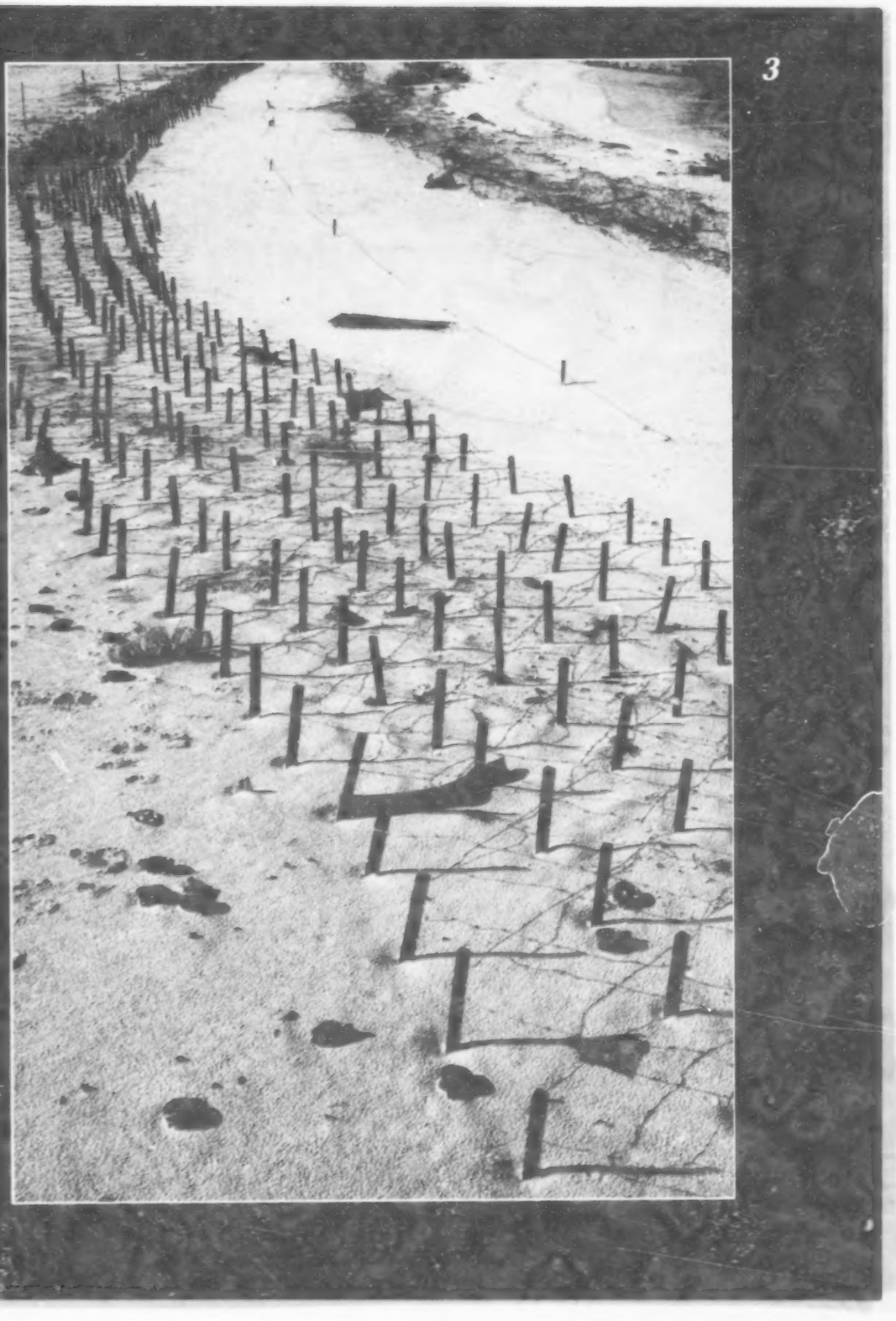
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